AIR FORCE JOURNAL of LOGISTICS

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1985

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SPECIAL SECTION:

DEVELOPING & EDUCATING AIR FORCE LOGISTICIANS

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AFJL Special Section

DEVELOPING AND EDUCATING AIR FORCE LOGISTICIANS

This edition of the AF Journal of Logistics deals with the professional education and training of the men and women of the logistics career area. I urge you to read the article on Rivet Workforce to see what we are doing with our enlisted maintenance folks. You should read the article about the Logistics Civilian Career Enhancement Program (LCCEP) and the objective to crossflow people to create a broader base of capabilities in our Air Force civilian work force. There are other articles on education and training—all designed to get the word out about what we are doing—what we must do—to deal with tomorrow. The future will bring a different set of circumstances (notice I did not say problems) with which we must deal. The Air Force of the future will evolve more rapidly than we think, hastened by an exploding technology and by socioeconomic forces already in motion. The digital computer embedded in weapon systems brings degrees of integration never before possible. That same digital technology will buy us tools to support our logistics processes which we have not even imagined up to this point. Demographic and national economic circumstances will ensure we will continue to be pushed to extract the maximum from the people and resources the electorate can afford us.

All these factors serve notice that tomorrow's logisticians must have a much better, more complete understanding of the entire flow of our logistics processes. No longer can we afford to build discrete specialists in maintenance, or munitions, or supply, or transportation. To understand your particular discipline is no longer enough; you must fully understand the part you play in the entire logistics process and be able to see where you are helping or benefiting that process. That does not mean that you should not know your own mission area well. On the contrary, you must know it better than ever and also those that impinge on it.

I do not know the exact course the future will take, but I do know this—the future will come whether we are ready or not. The challenge to tomorrow's logistician is to become exactly that—a complete logistician. You will not become a complete logistician until you know or can appreciate the contributions of the separate discrete disciplines to the whole. That complete logistician will then be able to achieve the synergism required and thus design and operate a logistics system which will indeed be greater than the sum of its individual parts. You have a part to play and it starts with professional development, education, and training.

Lieutenant General Leo Marquez
Deputy Chief of Staff
Logistics and Engineering, HQ USAF

UPDATE: LOGISTICS OFFICER CAREER DEVELOPMENT

The minutes of the 1984 Air Force Logistics Conference (Future Look) reflected concern about whether the Air Force is properly "raising" its senior logistics leadership. No other field demands the synchronization of so many elements and specialties; yet, successful careers are often those that have "stovepiped" to the top of a specialty area with very little opportunity to really understand the various elements of logistics and orchestrate them into a balanced combat support capability. Lieutenant General Leo Marquez described the danger: "Not recognizing that we need *leaders* instead of maintenance officers or supply officers, we have allowed these officers to reach senior positions unprepared to manage the totality of a complex system."

To address the problem, an Air Staff "tiger team" developed a Logistics Career Development Plan (LCDP) aimed at providing greater cross-flow of officers between logistics specialties. The 1985 Future Look conferees directed it be revised to reflect a less structured system. That effort will soon be completed via an agreement between AF/LE and AFMPC to establish an information system to develop logistics leaders who have a broad base of knowledge and capability within the various logistics disciplines. Emphasis is on this system being informal and flexible. The objective is to produce logistics officers with knowledge and experience in two or more logistics disciplines. More information will be provided in subsequent *AFJL* issues.

The Aircraft Maintenance Workforce Now and in the Twenty-First Century

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This paper discusses impacts of new concepts of Air Force tactical operations on aircraft maintenance manpower and outlines how force management policies are being revised to better support those concepts. An initiative called Rivet Workforce is providing the leadership and structure necessary to develop and evaluate alternative solutions to maintenance manpower and job performance problems. These solutions will require broadening the job skills and task training of maintenance specialties and integrating and reorienting manpower, personnel, and training policies toward current and foreseeable Air Force needs. Principles and criteria used by Rivet Workforce to select and evaluate potential job specialty restructures are discussed.

Introduction

The Air Force divides its 135,000 aircraft maintainers (29% of the enlisted force) into 43 distinct job categories called Air Force specialties (AFSs) and more than 60 finer subdivisions, called "shreds." Some of these AFSs are small and highly specialized groups, such as A-10 intermediate test station technicians, and others are very large and relatively unspecialized, such as aircraft "crew chiefs." The complexity and diversity of this maintenance workforce specialty structure mirrors the complexity and diversity of aircraft now in the inventory. In short, growth in hardware technology has meant growth in the number of AFSs required to keep it operable. Specialty growth, in turn, has helped make maintenance organizations very manpower intensive.

For example, a typical fighter wing of 72 aircraft requires up to 1,800 maintenance people. Deployment of a single squadron of 24 F-15 or F-16 aircraft can require almost 600 people for flight-line aircraft generation and recovery, intermediate avionics maintenance, limited intermediate maintenance for other aircraft subsystems, and munitions support. This manning requirement is driven in part by the need to take along between 21 and 25 separate AFSs. This manpower-intensive, highly specialized maintenance organization was tolerable while manpower was relatively abundant and inexpensive; air superiority permitted operations from large, fixed, industrialized main operating bases; and massed force was more important than force mobility.

But increased manpower costs are coinciding with greatly altered concepts of force employment that will compel us to change the way we train, classify, and manage the maintenance workforce. Over the next five years, we will expand the force structure, but increases in end-strength authorizations will almost surely not keep pace. Since competition among the Services for a dwindling manpower pool may intensify, reducing the demand for more manpower by increasing the productivity of the current workforce may become a hard requirement.

Compounding this manpower problem is a change in the way the Air Force plans to fight. To counter the growing attack vulnerability of its large, fixed main operating bases, the Air Force plans to fight in small units from large numbers of dispersed locations. This *Air Force 2000* dispersed air basing strategy will emphasize unit mobility, flexibility, and autonomy, and will require a leaner, more broadly trained maintenance workforce. Logistics simulation studies using F-16 operations as a baseline have shown that total manpower requirements *with the current AFS policy* could almost double when a 72-aircraft wing fights in units of four from 18 dispersed sites. This manpower penalty of small unit, dispersed operations cannot be met with more manpower alone; we do not have enough people. However, the same studies also show that sortie rates equal to a consolidated main operating base can be achieved with fewer maintainers if cross-utilization at dispersed sites could be expanded. In other words, restructuring maintenance AFSs can largely overcome the manpower diseconomies produced by small unit operations.

This is not to imply that maintenance manpower is the sole—or even the most important—barrier to successfully implementing the dispersed air base scenario. To be sure, transportation, fuel, parts stockage, battle damage repair, and command and control are also dominant concerns. Still, maintenance manpower, personnel, and training (MPT) policies need to begin moving now toward the following goals:

- Increase manpower productivity and combat capability by prudent restructuring of maintenance job specialties.
- Orient training, assignments, and career progression around specific weapon systems, or families of similar weapon systems, as much as possible, to deepen and protect experience.
- Reduce total unit manpower requirements in order to improve unit mobility and flexibility. Since total Air Force demands for manpower cannot be allowed to grow, expanding the scope and content of current maintenance jobs will result in leaner combat units. And, especially within the context of air base dispersal, multi-skilled maintainers may become a force multiplier.

Movement toward these goals will be accelerated through renewed emphasis on equipment design and maintenance concepts known to impact both maintenance MPT requirements and sortie generating capability. Two additional goals for future designs may thus be defined (or reaffirmed, since they are not at all new):

• Reduce maintenance workload and increase weapon system availability through improved component reliability and maintainability.

• Maximize "on-equipment" repair capability and reduce need for deployed support equipment and complex, collocated "off-equipment" repair facilities.

These five goals are highly compatible, but there has been a tendency to link achievement of the first three to achievement of the last two. In fact, though, there is ample room to work the "AFS problem" independently to greatly improve maintenance capability now, on *current* weapon systems, while shaping maintenance MPT policy that anticipates *new* weapon systems and concepts of force operation. Despite the projected growth in the force structure, most of the aircraft the Air Force will have in the year 2000 are in the inventory now. So restructuring of maintenance AFSs must be oriented toward existing aircraft and be workable in the near- and mid-term, not predicated wholly on new designs and focused on the very long term. Second, substantial improvements in maintenance capability can be realized in the short run through better integration of manpower, personnel, and training policy and improved ability to forecast the long-term interactive impacts on the MPT "system" as a whole and on the maintenance performance capability of single units. In other words, smarter management of the maintenance workforce would help overcome many problems and resolve conflicting MPT policies. Third, as the limits of feasible AFS restructuring with existing weapon systems become better known, the role of improved equipment reliability and maintainability will be better defined, and, one may hope, more effectively targeted for future systems.

Rivet Workforce— Spurring Innovation and Managing Transition

The vehicle for initiating and shaping proposals on aircraft maintenance job expansion, and for evaluating the myriad of MPT cost impacts of AFS restructuring, is called **Rivet Workforce.** This initiative, led by the Air Staff (Maintenance Policy Division, AF/LEYM, and Manpower and Personnel, AF/MP) and with the participation of all major commands (MAJCOMs), is aimed specifically at the following objectives:

(1) **Orient maintainers to a particular weapon system, or family of similar weapon systems, through the 7-skill level (Master Sergeant).** The objective is to promote and protect specific expertise and circumvent retraining problems. At present, shreds are retained only through the 5-level or journeyman, and shreds do not apply at all to many specialties.

(2) **Combine AFSs having underlying similar technologies where prudent, and focus new job classifications on organizational or "on-equipment" maintenance tasks.** This objective envisions the broadening of task responsibility across aircraft subsystems and the possible separation of tasks required to "fix the airplane" (principally troubleshooting and remove/replace actions) from tasks required to "fix the box" (principally test/troubleshoot and repair of components removed from the aircraft). The number of separate specialties per aircraft would be reduced, manpower requirements for deployment lowered, and maintenance capability and sustainability enhanced.

(3) **Focus training and career development policies on growth from Airman to Master Sergeant.** The mix of training modes—in residence technical school, on-the-job training, and career development courses—will be tailored to specific job/task requirements and will be phased over an airman's entire career. At present, resident technical training is front-loaded in the first enlistment, and on-the-job training requirements significantly diminish the productivity of the first-term workforce. Often, though, the job/task competency gained during the first assignment is not fully transferable to follow-on assignments if different aircraft, often encompassing different technology vintages and hardware designs, are involved.

(4) **Revisit unit manpower standards following AFS restructuring to assure minimum requirements are still met.** Although the primary driver of maintenance manpower is workload, and workload is driven by the flying schedule and equipment reliability and maintainability, total manning is also affected by the number of separate skills required for maintenance. If people could freely substitute for one another, manpower utilization would improve and sortie generation might improve as well. Current authorizations should be preserved during transition and until mission capability with structured AFSs has been demonstrated. And unit manpower studies should include the possibility of reallocating manpower to better balance workload.

Principles Guiding Redefinition of Maintenance AFSCs

The process of redefining the AFS structure is guided by the following principles:

(1) Maintenance tasks should be characterized as either "on-equipment" or "off-equipment." To the extent possible, specialties will be defined, and technicians should be trained and assigned based on this distinction.

(2) While restructures will be made within both domains, "on-equipment" job groupings will be weapon system specific for the most part and controlled through the 7-skill level, while most "off-equipment" jobs need not be tied to specific weapon systems.

(3) Since "on-equipment" job specialties will constitute the majority of the deployed force, reducing specialization on the flight line will have the most immediate beneficial impacts.

(4) All proposed restructures must be adjudged to be workable from the standpoint of task skill/learning breadth and to be supportable by the Air Force personnel management and training systems. Cost impacts, especially concerning training, will be quantified and balanced with offsetting cost savings that can be identified.

(5) Proposals will be developed and staffed with the full participation of all MAJCOMs and with recognition of the differences in missions, equipment, and maintenance requirements among them.

The Rivet Workforce Process

Revising a maintenance career structure that has evolved over decades into its present state, and includes about 29% of the Air Force enlisted force, is a formidable task. The Air Force specialty code, a five-digit numeric designation, appears to merely define the job classification of Air Force people. But it also influences the recruitment, training, assignment, career progression, and retention needs of the Air Force. Hence, to change an AFS definition is to potentially change many other aspects of personnel and training management. To be sure, minor changes in the classification structure are made frequently and are a routine fact of life in the Air Force. But

Rivet Workforce, with its fundamental reorientation of classification policy and its broad scope and impact, requires a special organization and approach.

The organization is embodied in a Rivet Workforce Task Force which is composed of about 75 officers and enlisted people drawn from maintenance career fields, manpower, personnel, training, and research communities. The Task Force is divided into seven working groups called Tiger Teams which address specific issues in key areas: Classification, Training, Manpower, Personnel, Funding, Integration, and Publicity. In many respects, the Classification Tiger Team is the leading group; it initiates proposed AFS mergers, conducts classification workshops, and prepares and distributes restructure packages for other Tiger Teams to evaluate and refine. The Maintenance Policy Division (USAF/LEYM) provides overall coordination and guidance.

The approach emphasizes the use of workshops for each set of AFSs targeted for possible restructure. These workshops, conducted by the Classification Tiger Team, convene job incumbents from the specific AFSs under review with other subject matter experts and with personnel, training, and task analysis specialists for week-long meetings. The objective of the workshops is to enumerate and evaluate alternative ways of reallocating the tasks or jobs of the AFSs (or of related AFSs, if applicable). As many as nine restructure options have been devised and evaluated by the subject matter experts at these workshops so far.

A number of criteria to aid evaluation of alternatives have been used. These include task learning "saturation," training cost and training mix, population size, career advancement, assignment imbalances, and many others. The workshop participants eventually settle on a single restructure option. This option, along with other options considered but rejected, is written up and distributed to the other Tiger Teams for analysis and refinement. Each Tiger Team has specific taskings, coordination requirements, and deadlines in working each successive restructure proposal.

Once a proposal is "Rivet Workforced"—a process that takes about 90 days—major commands review it. After approval, conversion would be phased over several years. In principle and in fact, the development of workable AFS restructure plans is a separate issue from the sequence and timetable for implementing those plans. Preconversion planning may include provision for field testing and validation of restructured AFSs to identify problems and work solutions. The *evolutionary* approach to implementation should minimize turbulence to the workforce and allow mission needs to be met—that is, to still fly—during the transition period.

Conclusion

Rivet Workforce is the vehicle for orderly, proactive changes in aircraft maintenance manpower, personnel, and training policy. It is driven by the need to infuse greater flexibility, resilience, and autonomy into maintenance units to better support evolving Air Force combat doctrine. It is based on the assumption that significant progress toward these goals can be made in the short run through reclassifying maintenance jobs and through corresponding changes in manpower, personnel, and training policies. In addition, barriers to job mergers are often created as much by the way people are trained, assigned, and used as by aptitude requirements, task training difficulty, and the range of tasks to be learned. Indeed, distinguishing the former from the latter is itself a barrier.

Though compromises and trade-offs on specific AFS restructures will be made as the Rivet Workforce process moves along, the blueprint for future maintenance job structures is being clearly and inexorably drawn. We need to find and to fully exploit all means to improve maintenance capability and do it with fewer people. The challenges of future combat require that we do no less today. In focusing the attention of the maintenance community on those challenges, and in bringing forth specific proposals responsive to them, Rivet Workforce has already made important contributions toward preparing the Air Force for the twenty-first century.

Beyond Rivet Workforce

Research is being conducted to determine how USAF should structure maintenance jobs to ensure adequate combat task coverage in the future. One such study by the Air Force Human Resources Laboratory (HRL) is called Small Unit Maintenance Manpower Analysis (SUMMA). The SUMMA objective is to develop, refine, and integrate methods for evaluating alternative maintenance jobs, occupations, or AFSs in light of current and foreseeable Air Force combat needs. Fulfilling this general objective requires research and technology development in several dimensions to:

- develop a scenario-based method for projecting combat maintenance task requirements for both dispersed, small unit operations and nondispersed, consolidated operations;
- develop a method for aggregating combat tasks based on specified sets of criteria;
- develop relevant, valid methods for assessing feasibility of alternative task allocation;
- develop software for automated or semiautomated system models linking the above methods to permit simultaneous evaluation of sortie production capability with different manpower/specialty mixes.

SUMMA will focus initially on F-16 combat operations, basing, and maintenance requirements. Previous studies and simulations will help establish baseline logistics requirements. For example, the Logistics Composite Model (LCOM) will be used to evaluate impacts of combat dispersal and potential for recovery. Workloads and frequencies will be identified for both peacetime and wartime.

The unique SUMMA contribution will be to devise a Task Allocation Model through mathematical optimization techniques that can aid, and at least partially automate, the task allocation (or AFS restructure) evaluation process. The effort will yield the data and methodologies needed to answer pressing questions on maintenance policy, including:

- Is it possible, given current equipment reliability and maintainability levels, for one person to learn all or most of the "on-equipment" maintenance tasks for a single aircraft? Can we/should we develop small numbers of "super AFSs" trained in-depth in critical or complex subsystems and large numbers of versatile "generalists" trained in direct, sortie producing skills?
- What impact would an AFS merger have on unit manpower requirements, career progression, satisfaction, retention, and personnel costs?
- What tasks or functions now performed by non-maintenance AFSs should be included within maintenance AFSs, and what non-maintenance duties should be excluded from maintenance AFSs?

The Logistics Civilian Career Enhancement Program: Career Development Opportunities

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As a result of a decision made at the February 1985 Logistics Civilian Career Enhancement Program (LCCEP) Policy Council Meeting, increased emphasis is being placed on career development. In order to provide well-rounded, highly qualified people to step into the shoes of retiring senior logisticians, Cadre members and high potential registrants will be provided a variety of opportunities for both short-term and long-term full-time training and career broadening assignments. The Career Development Panel, chaired by Mr Alan K. Olsen, Directorate of Maintenance and Supply (HQ USAF/LEY), is responsible for implementing these new initiatives.

The LCCEP encourages high potential employees who are striving to move into higher management ranks to demonstrate their personal initiative and achievement. This article explains LCCEP-sponsored career development and training opportunities now available.

Career Broadening Assignments

Career broadening assignments allow Cadre personnel and high potential LCCEP registrants to gain practical knowledge of different aspects of logistics than previously experienced. They are planned for a nominal 24-month period and often include a temporary promotion for the participant. In order to maintain a bank of career broadening candidates to be used for openings throughout the year, career broadening nomination invitations are issued twice a year. The positions are filled through an LCCEP panel process that reviews proposed broadening assignments.

Office of Civilian Personnel Operations (OCPO) career broadening positions are tailored to meet the specific needs identified in the career broadening nomination package; therefore, OCPO positions may be relocated to major command (MAJCOM) or air logistics center (ALC) organizations based upon the career broadener's specific identified need. For example, an individual working in the F-16 area at an ALC might want to gain experience and personal contacts with the USAFE organization working the F-16. In this instance, an OCPO career broadening position would be established within USAFE to accommodate that need.

Examples of benefits an individual might derive from participating in a career broadening tour are acquisition of additional experience in a different occupational series, skill code, level of command (field, MAJCOM, HQ USAF), logistics family (distribution to logistics plans, maintenance to materiel management, transportation to acquisition, etc.), or command (i.e., MAC to AFLC, AFLC to SAC, AFSC to USAFE). Other benefits, in terms of permanent change of station (PCS) entitlements, are summarized in Table 1.

CONUS, Hawaii, and Alaska
18,000 pounds household goods shipment
90 days temporary storage
60 days temporary quarters and subsistence (can be extended up to 120 days if written justification is submitted)
Real estate expense reimbursement
CONUS Only
Househunting trip for employee and spouse (deducted from 60 days temporary quarters)
Overseas
Overseas entitlements will be determined by the overseas servicing CCPO

Table 1: PCS Entitlements.

In addition to benefiting the career broadener, the Air Force also gains from the program. The new experience is applied to problem-solving in the planned post-broadening assignment, which may be the individual's current duty location or another location identified by the senior endorsing logistician. Also, benefits are provided from the prior diverse experience perspective the individual brings to the career broadening assignment.

Professional Enhancement Program

The Professional Enhancement Program is a one-year training program designed to enhance the participant's career development by providing experience at the Office of Assistant Secretary of Defense (OASD) level. The assignments are for one year, and participants are in a TDY status. Limited PCS or per diem (whichever is most cost-effective for the Air Force) is funded through LCCEP.

Nominees must be LCCEP registrants, normally in grades GS-12 through GM-14, and Cadre members are given preference. The following defines the career fields included in this program, indicates their special requirements, and provides a brief description:

International Logistics Management Professional Enhancement Program. Nominees must be in the international logistics field and have demonstrated the potential for increased international logistics management responsibility. Participants normally will be assigned for six months in the Directorate for International Logistics, OASD;

three months in the Defense Security Assistance Agency (DSAA); and the remaining three months in another service agency or the Defense Logistics Agency (DLA). The specific assignments for this last three-month period will be determined at the time of selection.

Maintenance Management Professional Enhancement Program. Nominees must have a maintenance background. Experience at both ALC and AFLC Headquarters is desirable for individuals with depot-oriented maintenance background. Similarly, a combination of base and MAJCOM headquarters experience is desirable for those with a base-oriented background. The program is designed to enhance the participant's career development by providing experience at the OASD level.

Supply Management Professional Enhancement Program. Nominees should have experience within supply, distribution, materiel management, or plans and programs related to supply-side activities. The program affords participants an opportunity to gain experience at the OASD level, with other services, and with the DLA through rotational assignments.

Transportation Management Professional Enhancement Program. Nominees are required to have a transportation background, and individuals must have demonstrated the potential for increased transportation management responsibility. The program provides an opportunity to increase effective intermodal transportation management through cross-training. Specific rotational assignments are tailored to the individual needs of the participant.

Long-Term Full-Time Training

The long-term full-time (LTFT) training program is designed to allow Cadre members and high potential registrants to attend colleges, universities, military service schools, or other types of training on a full-time basis. Since this type of training is a limited and expensive resource, it may only be authorized when necessary to benefit the government. Consequently, a senior logistician must approve the nomination and post-training utilization plan at organizational level. Nomination packages are then forwarded to MAJCOM headquarters through personnel channels for senior logistician endorsement prior to submission to OCPO/MPKCL.

Historically, individuals in commands with small populations of civilian logisticians have been unable to participate in LCCEP's LTFT training opportunities because of inadequate manning to cover positions during extended absences. Future LTFT training nomination invitations will include a statement that nominations may be submitted contingent upon provision of a career broadening backfill. Normally, the large AFLC population centers will not require such relief.

When a nomination contingent upon backfill is received, and about eight months prior to the beginning of the training, a targeted career broadening invitation will be issued to recruit for the backfill. Lead times should allow the selectee to be in place two months prior to departure of the individual selected for training. The backfill career broadener will remain in place a minimum of one calendar year, until the incumbent returns from training, or until the position is otherwise filled, whichever is longer. Commands may negotiate through the LCCEP PALACE TEAM if overlap following return of the incumbent is required.

Air Force Institute of Technology (AFIT). Employees interested in pursuing advanced study in logistics management, transportation management, maintenance management, or systems management can apply for AFIT Graduate Logistics Management Training. This is an intensive 15-month program at Wright-Patterson AFB, Ohio. It runs from June through August of the following year. Applicants must hold a bachelor's degree, provide an official transcript from each college/university attended, supply a copy of their graduate record exam aptitude or graduate management admission test scores, and obtain an AFIT letter of acceptance.

Civilian Institutions - Graduate Level. Another option for personnel with bachelor's degrees is a 12-month program that begins in August/September at various civilian institutions throughout the country. Graduate study must be *related* to the logistics career field. The same documentation required for the AFIT Graduate Program applies to this option, except that the letter of acceptance will be from the civilian institution. In addition, a copy of the planned course of study approved by the civilian institution, along with a short description of each course, must be provided.

Civilian Institutions - Upper Level Undergraduate. Under this pilot program, registrants with 90 semester hours in an undergraduate program may apply for up to 12 months of study in any logistics management-*related* field at a civilian institution. Nomination packages must include the specific training required and a post-training plan identifying specific benefits this training will provide for the Air Force. The program normally runs September through August. In addition, an official transcript from each college or university attended, a copy of the planned logistics-related course work, and a copy of a letter of acceptance for proposed course work from the civilian institution must be included.

AFIT Training with Industry (TWI). The TWI program is essentially a career broadening assignment designed to improve the management, technical, and professional competence of the participating employee. AFIT, in cooperation with OCPO, has developed a program which offers Air Force civilian employees an opportunity to obtain experience through exposure to an industrial environment. The knowledge to be gained by the employee in this ten-month program must be of benefit to the Air Force upon the participant's return to duty.

Nominees must be at least GS-11s or equivalent, have a bachelor's degree, and have demonstrated tact and diplomacy in working with senior managers and executives. After nominations are rated and ranked, nomination packages are forwarded to AFIT for negotiation of a no-cost contract with a receptive corporation.

Limited PCS or per diem (whichever is most cost-effective for the Air Force) is funded through LCCEP for the ten months of the program.

Air Force-Wide Competitive Senior and Mid-Level Management Development Programs

Nominees for attendance at senior and mid-level management development courses must be in a position which requires knowledge of, or has decision-making responsibility for, one or more of the following areas: international affairs; military foreign policy relationships; military planning; intelligence; joint activities of the Armed Forces; general structure/organization of Department of Defense (DOD) and

other government security agencies; or management of national security resources and related economic, social, political, environmental, technological, administrative, and military factors.

Nominations must be endorsed by MAJCOM senior logisticians and submitted through the local and MAJCOM DPC training office to OCPO/MPKCL. Nomination packages are reviewed and ranked by the LCCEP Career Development Panel and forwarded to HQ USAF/MPKZ. LCCEP is not provided specific quotas; an Air Force-wide Panel convenes to review ranked listings as well as nomination packages to make final selections.

In some cases, nominees may be selected for an equivalent school other than the original nomination (i.e., nominated for the Air Command and Staff College, but selected for the Armed Forces Staff College) if the Panel believes it to be in the best interest of the Air Force and the individual.

Senior Professional Military Education

There are three LTFT professional military education (PME) opportunities for senior level (GM-15s and high potential GS/GM-14s) logisticians under the program. The first, the *National War College (NWC),* is a major component of the National Defense University and is the only senior service college in the military education system with the specific mission to study national security policy preparation. The ten-month course prepares selected personnel of the Armed Forces, the Department of State, and other United States (US) government departments and agencies for joint and combined high-level policy, command, and staff functions in planning and implementing national strategy.

The *Air War College (AWC)* is the senior level Air Force PME school. The curriculum stresses the application of aerospace power. A major part of the academic year is devoted to critical analyses of current strategy with a view toward developing optimum alternative future strategies. The ten-month course provides for an in-depth evaluation of US and allied capabilities across the broad spectrum of conflict. It also includes instruction on modern analytical techniques used by the DOD to evaluate competing strategies and weapon systems.

The *Industrial College of the Armed Forces (ICAF),* another major component of the National Defense University, operates under the direction of the Joint Chiefs of Staff. ICAF focuses on managing resources for national security. Nominees for this ten-month course must hold a position that entails considerable decision-making responsibility covering management of national security resources including economic, social, political, environmental, technological, administrative, and military factors. Further, the employee's position should require an in-depth understanding of the principles, policies, operations, and organizations involved in national and international security affairs.

Mid-Level Professional Military Education

Two LTFT training opportunities are available at the mid-management level (GS-12 and above). *The Armed Forces Staff College (AFSC),* a six-month course, covers joint and combined organizations and operational planning, the supporting organizations and operations of the US military services, and related aspects of national and international security. The *Air Command and Staff College (ACSC),* a ten-month program, develops leadership and management skills for understanding the organization, policies, and programs by which the Air Force functions. Skills for logical reasoning, creative problem-solving, effective communication, and organizing for military decision-making are woven into a curriculum covering the acquisition and employment of aerospace power.

Education Programs for Federal Officials and Public Management

Two LTFT opportunities for GS/GM-13 through 15 logisticians are available under this program and one program is offered through OPM.

Harvard University. The Education for Public Management (EPM) Program is a nine-month program in which participants are enrolled in Harvard's Masters in Public Administration (MPA) Program. It is designed to strengthen policy analysis and management skills for positions of greater leadership and responsibility. Candidates must be in grades GS/GM-13 through 15 and have a minimum of five years of full-time work experience of significant quality and depth, demonstrated ability to perform well in a flexible interdisciplinary academic program, and displayed potential for future leadership. If selected by the Air Force selection panel, the nominee must take the Graduate Admissions Test and be admitted to the MPA program as a degree candidate.

Princeton University. The Educational Program for Federal Officials at Mid-Career Program at Princeton University is a nine-month, nondegree program designed for government officials in grades GS/GM-13 through 15. The program is intended to prepare officials to assume general executive responsibility, particularly in positions involving formulating and implementing broad public policy. Officials admitted to the program participate in an individually tailored nondegree program of continuing professional education.

LEGIS Fellows Program. The Office of Personnel Management (OPM) sponsors the LEGIS Fellows Program, a four-month developmental assignment for employees whose current or prospective positions may require a working knowledge of Congress. The training includes a briefing session on the operation and organization of Congress and assignment with a member of Congress or committee staff for approximately four months. Nominees must have completed at least two years of Federal service in the executive branch and must have demonstrated flexibility in work habits; ability to work in an unstructured environment; ability to initiate work and to perform independently; and an interest in legislative procedures, practices, and techniques.

Short-Term Training

Short-term training is also provided by the LCCEP for Cadre members and high potential registrants. Allocations for spaces are determined by requirements entered into the required training area (RTA) of the Personnel Data System-Civilian (PDS-C) by local CCPOs. In order to be considered for this training, candidates should include needs in their annual RTA updates.

OPM Executive Seminar Courses. GS/GM-13s through 15s are eligible to attend several two-week residential seminars designed to meet varied training needs of government managers and executives. The following two-week courses are offered at various times throughout the year: Administration of

Public Policy, Federal Program Management, Economics and Public Policy Seminar, Science Technology, Public Policy, National Security Policy, Seminar for New Managers, Executive Development Seminar, Current Issues Seminar, Federal Personnel Management Issues, The Role of the Government in Technology Transfer, Managerial Competencies and Effectiveness Characteristics for Executives, and Management Development Seminar.

OPM On-Site Courses. Several on-site short-term courses are scheduled for various locations throughout the Air Force. Regional sites were selected based on high density population of LCCEP Cadre members/registrants. For FY86, 36 classes on six different topics will be presented, for a total of 1,080 students.

COURSE	*ELIGIBLE*
Toward Excellence	GS/GM-13, 14, 15
Management Effectiveness Seminar	GS/GM-13, 14, 15
Executive Leadership Seminar	GS/GM-13, 14, 15
Manager and Program Planning and Evaluation	GS-11, 12
Advanced Management Seminar	GS-11, 12
Seminar on Executive and Management Effectiveness	GS-11,12

GM-15 Contingency Opportunities

Nominations for the following programs are normally for Senior Executive Service (SES) members; however, high potential GM-15s may be nominated to compete for excess allocations. Nominations are completed by senior logistics managers and submitted through the MAJCOM MPK or DPC training function to OCPO/MPKCL. The LCCEP Career Development Panel rates and ranks candidates and forwards packages to HQ USAF/MPKZ where a panel makes final selection from all competing Air Force nominations. The LCCEP is not provided a specific quota.

Harvard University. Harvard University offers two opportunities: the Advanced Managers Program (AMP) and the Defense Senior Manager's Course. The AMP is an integral part of the Harvard University Graduate School of Business Administration. The course is 13 weeks long and is composed of 160 experienced managers of demonstrated ability. Size is important because one of the program's values is the close association among so many executives from a wide range of industries and organizations all over the world. Because of the intensity of the academic program, AMP participants live on campus. The Defense Senior Manager's Course is designed to help prepare senior officials to meet new challenges in national security. It is a rigorous eight-week program aimed at preparing individuals for increased executive responsibility in implementing national security policies and programs.

Federal Executive Institute (FEI). The FEI is a residential center for advanced study and executive development for senior executives in the Federal government. Operated by the OPM, it focuses on major problems facing our society, the function of government with respect to those problems, and ways in which the administration of government might be improved. This four-week course addresses the broad perspectives necessary for the Senior Executive Service.

Conclusion

The LCCEP offers a wide variety of career development opportunities. However, setting career goals and devising a plan to assure achievement of those goals require a great deal of personal effort. Logisticians should critically assess their strong and weak points, achievements, experience, and long-term career interests. They should gather information about their organization's needs, projected managerial vacancies, and the competencies which will be required in those positions. It is also valuable to discuss these plans with supervisors or other trusted management officials. Career-oriented logisticians should analyze all information gathered in order to make tentative decisions about career goals and developmental objectives. Then, they must keep looking for opportunities that can lead to established goals and ensure their training needs are included in RTAs. When building career goals to meet specific needs, logisticians must be knowledgeable of all career development opportunities; however, since the purpose of career development is not only to meet individual needs but also those of the Air Force, career development goals must be developed with approval by senior management.

Career Program for Acquisition Civilians

The Acquisition Civilian Career Enhancement Program (ACCEP) is nearing its debut for the contracting, manufacturing, and quality assurance career fields. This program is the result of functional and personnel managers joining forces to develop a career force strategy for increased professionalism. Oriented toward a systems approach, ACCEP will place responsibility for decisions on career management issues with key functional managers through a career board structure. Also, this program will combine decentralized management with centralized oversight and support. A PALACE Team of functional and personnel specialists has been set up to accomplish work force analyses and centralized management of many training and development opportunities. As the ACCEP begins to take shape, the potential for increased professionalism will become more apparent.

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Air Force Combat Logistics: An Education Plan

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Background

Since the end of the Vietnam War, several developments have given Air Force leaders cause for concern over a potential weakening of the war-fighting ability of our service. First, many Air Force members with combat experience in World War II, Korea, or Vietnam have returned to civilian life, taking their useful perspectives with them. Second, the United States (US) has not deployed men or equipment on a large scale for major, sustained combat operations within the last decade. Third, the divisive nature of the Vietnam conflict ushered in a period of national reassessment of many military matters. In fact, by observing America's historical isolationism following previous wars, one might have forecast just such a period of careful scrutiny for military programs. National priorities were refocused on domestic, economic, and social concerns requiring military members, in part, to become experts in the management of scarce defense dollars.

One significant event in the late 1970s, however, served to at least partially correct this underemphasis on US war-fighting ability. The Iranian hostage crisis signaled a threefold failure in the exercise of American national power. The military failure was most evident in the aborted rescue attempt. Less evident, but perhaps even more serious, were the intelligence and the diplomatic failures accompanying the rise of Ayatollah Khomeini. Since intelligence agencies gave little importance to anti-monarchial groups in Iran, Washington officials faced a diplomatic "Pearl Harbor" at the Shah's overthrow. They were ill-prepared to deal with the new Islamic Republic (1:142). These events certainly caused Americans to reflect on their war-fighting capability. (2)

If the hostage crisis had been an isolated occurrence of world tension, recovery of the US war-fighting perspective may have lost momentum. However, conflicts in the Falklands, Lebanon, Afghanistan, and Central America have kept US defense issues very alive throughout the early 1980s. Further evidence of concern about US defense can be seen in the increasing congressional budget outlays for this function. (3:71)

This shift in public mood appears also to correlate with circumstances in the military. For instance, "within the Air Force . . . recent trends point to a shift back to the war-fighting perspective lost in the 1970s (4:268)." General Lew Allen, former Air Force Chief of Staff, introduced Project Warrior as a significant effort to improve the war-fighting spirit and outlook of Air Force people and increase their understanding of air war theory and practice (5:56). General Allen observed that in learning the art of war, Air Force personnel must be able to transcend immediate tasks and give "adequate attention to the war-fighting dimensions of possible future conflicts (6:269)."

Logistics and War-Fighting

Perhaps nowhere is the attention to war-fighting dimensions more critical to the Air Force than in the field of logistics. In a general sense, it has been claimed "tactics wins battles, but logistics wins wars (7:35)." More specifically, logistics provides the "muscle" for an air force to deliver its war-fighting potential (8:3). The US Air Force may need to exercise its logistics muscle at different levels of conflicts ranging from low level contingencies, to theater conflicts, to the herculean challenge of global warfare (9:62). This strategy requires that our forces be capable of fighting at any level of conflict and be able to move quickly across the continuum of conflict.

Recognizing the importance of logistics, then, one could reasonably deduce from preceding issues that there is an ongoing need for logisticians to relate their activities to possible wartime scenarios and to maintain a combat mentality. In combat, the timely action of logisticians, whether it be spare parts delivery or avionics maintenance, may save lives. However, because many inexperienced logisticians do not face front-line duties in a peacetime CONUS environment, it may be easier for them to adopt an "eight-to-five" mentality. This mentality had no place at the air bases in Southeast Asia where "loggies" worked 60-80 hours per week or longer, as many still do today. Training programs should develop the logisticians' sense of urgency now since in wartime their actions will affect those performing the traditional direct combat or front-line roles. This interaction with weapons operators must be positive and synergistic, especially since history has shown that **the war-fighting spirit within the individual and the institution as a whole may spell the difference between victory or defeat in combat** (10:270). Both the Vietnam and Afghanistan conflicts stand as evidence supporting this role of the war-fighting spirit.

Another ongoing need in the field of Air Force logistics concerns the impact of technology. Today's complex technological environment requires people to maintain complex weapon systems and also demands a higher degree of specialization in most career fields (11:268). This development poses the danger that logisticians may become "functional specialists" who "are expected to have little understanding of the role they play in the overall war-fighting equation (12:268)." A recent *TIG Brief,* for example, pointed out that, at this time, transporters receive little, if any, training in understanding war plans and the planning process (13). To cure this lack of training, the *TIG Brief* encourages transporters to "maintain a close working relationship with base-level logistics plans personnel (14:10)," among other remedies. This specialization problem can even extend

internally to a specific logistics discipline. One study of combat supply procedures noted the degree of specialization in the supply system and recommended an alternative organizational structure under combat conditions (15:5,9).

Two needs currently exist in the field of Air Force logistics: a continuing need to relate logistics functions to combat activities and a commensurate ongoing need to avoid excessive functional specialization. The authors contend there exists a question as to whether these needs are being met adequately, particularly from an educational standpoint. Consequently, an opportunity presents itself to translate Project Warrior ideals into practical action for the Air Force logistician. Specifically, this article proposes to define and teach a body of knowledge entitled "Combat Logistics."

The Concept of Combat Logistics

There are many current initiatives within the Air Force Logistics Command (AFLC) which directly relate to combat logistics. One of the most crucial initiatives concerns the work of the Combat Logistics Support Squadrons (CLSSs). *Air Force Magazine* stated:

> Their principal purpose is to deal with crash- and battle-damaged aircraft and to provide augmented maintenance and supply support to operational forces overseas as well as in the CONUS. In fact, they have been expanding to include more capability in the aircraft battle-damage repair area. (16:30)

The advent of this effort stems from a lack of numerical air superiority in European theaters and the need to record Yankee ingenuity. CMSgt James P. Roeder, Jr., formerly of the CLSS, said that in Vietnam "if an F-4 came back that couldn't be fixed, it was pushed aside and a team flown in from the States to repair it. It might take a couple of months. . . (17:1)." War in Europe would disallow such luxuries. AFLC's Major General Monroe T. Smith, former commander, Air Force Acquisition Logistics Center, explained this reality:

> When you are behind the eight ball as we are with numbers of airplanes and numbers of anything you want to imagine, you can't afford to worry whether you patch this hole as good as new. All you want to do is generate sorties. If you've got a hole and it's between ribs and not affecting the structural integrity, all you want to do is put some duct tape over it and let that guy get off again and drop bombs. . . . (18:8)

Besides duct tape, other combat maintenance solutions may include replacing broken hydraulic lines with flexible hoses, replacing broken control rods with broomsticks, and deploying special depot repair teams for major maintenance to forward areas (19:8; 16:31). War veterans recognize these methods of valuable ingenuity; but, unless the methods are recorded, their benefits may be lost. To preserve those benefits, a technical manual on aircraft battle damage repair (ABDR) has been published and is being updated (20:8).

The ABDR "quick-fixes" discussed provide an excellent representation of combat logistics functions. These procedures illustrate different operational concepts between war and peacetime, and this discovery of differences may be the most beneficial aspect of the research. Education on combat logistics issues will indeed enhance the awareness of war-fighting requirements for Air Force personnel.

Justification

One might pose two questions at this point:

(1) Will an educational approach sufficiently address shortfalls in the strength of logistics war-fighting mentality and the need to avoid excessive specialization?

(2) Are those shortfalls real?

As to the first question, it is true that formal educational programs provide only part of the solution. A true war-fighting spirit requires leadership emphasis on basic military values such as teamwork, positive discipline, and dedication. On the other hand, the late General Jerome F. O'Malley provided some good insight to the first question. As DCS/Plans and Operations, HQ USAF, with the responsibility for the initiation of Project Warrior, he noted that "in the absence of another war, the lack of familiarity with war-fighting in the Air Force must be corrected through study and research (21)."

In some cases, education may be the only effective means to expose logisticians to certain areas of combat logistics. As an example, many current logisticians may not be aware of the excesses in material and equipment that tend to build up rapidly in the early stages of a conflict (22:5). Knowledge and anticipation of such combat phenomena would greatly assist in formulating rapid redistribution plans.

To justify research in the area of combat logistics, the second question about real shortfalls also requires a satisfactory answer. The fact that HQ USAF sponsored an Air Force Institute of Technology (AFIT) initiative to teach a combat logistics course provides the assurance that those educational needs do exist and are being addressed. In conjunction with Project Warrior's study and research mandate, correspondence between AFIT, AFLC, and HQ USAF identified a need to bridge the gap between the peacetime character of logistics courses and their wartime applications.

Objectives and Questions

To adequately address the dual needs of connecting logistics with war-fighting and diminishing functional specialization in the logistics field, the authors proposed creation of a "Combat Logistics" body of knowledge. Inevitably, problems occur with the use of such a relatively new term. How is *combat* logistics different from *regular* logistics? Answering this question is very important because the body of knowledge must exclude logistics procedures geared primarily for peacetime. How then can this filtering best be accomplished?

The preceding logic figures prominently in choosing the following objectives:

> *Objective 1*—to establish a system for determining topic relevance to combat logistics.

Concurrently, a question should be devised which directly supports the attainment of that objective. For the purpose of this paper, the terms "Combat Readiness Activity" and "Logistics Function" are used in the supporting question and elsewhere for specific reasons. "Combat Readiness Activity" confirms that Project Warrior ideals on war-fighting mentality are inherent in the effort. "Logistics Functions" implies the involvement of functional specialization. Specifically, the authors developed the following question to aid in accomplishing the first objective:

Question 1—What combat readiness activities and major logistics functions should be used as criteria for determining topic relevance to combat logistics?

To demonstrate the application of the analysis system from objective 1, the authors adopted a second objective and supporting question.

Objective 2—to recommend a baseline two-week course syllabus covering war-fighting issues from each of the major logistics functions.

Question 2—What specific combat-related topics should be discussed in a baseline two-week course covering war-fighting issues from the major logistics functions?

Table 1 displays the matrix which fulfills the first objective. This matrix was used to develop a course outline geared to logistics issues in a combat environment. According to the matrix, the *combat logistics* issues involved with the sample topic, Initial Preplanned Supply Support, are highlighted by the large dots.

The use of this matrix made narrow or broad topics readily apparent. Consequently, it became easy to see what topics should be covered because of their broad impact and which ones to avoid because they were too specialized. Unless some form of topic analysis is used, course developers may inadvertently build in functional specialization. By using the matrix, an instructor is not confined to primarily subjective topic choices based on his own possibly specialized background. The Combat Logistics Criteria Matrix, then, facilitates an instructor's decisions about course content.

COMBAT LOGISTICS CRITERIA MATRIX
TOPIC: INITIAL PREPLANNED SUPPLY SUPPORT

COMBAT READINESS ACTIVITY	LOGISTICS FUNCTION				
	SUPPLY	MAINT	TRANSP	PLANS	ACQUISITION
IDENTIFICATION OF UNITS	●	●		●	
INITIAL UNIT RATING					
SORTIE PLANNING		●		●	
MOBILITY			●	●	
RECEPTION	●	●	●	●	
C^3 I	●	●	●	●	
ATTRITION					
SURVIVABILITY & FLEXIBILITY	●	●	●	●	

Table 1: Sample Criteria Matrix.

Conclusions

The authors submit that teaching a combat logistics body of knowledge constitutes a positive step toward building that war-fighting orientation. Such a program implements the Project Warrior mandate for gaining war-fighting familiarity through research and study. Without this educational approach, ignorance of war-fighting can only increase as more and more Air Force personnel lack the wartime experience base. A combat logistics course would pinpoint wartime/peacetime procedural differences and lead to a better understanding of how to handle the wartime environment. In the final analysis, the course should produce one major realization: that war is not an abstract possibility, but a reality for which all USAF personnel must be ready.

The research thesis of Handy and McCool, condensed in this article, was the genesis of a Combat Logistics course offered by the Air Force Institute of Technology. See the box at the end of this article for a current course description and application information.

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COMBAT LOGISTICS AT AFIT

Many in the logistics community are unaware of AFIT's most recent effort in "real world" logistics education. LOG 066, Combat Logistics, was first offered this February as an attempt to make logistics managers in *all* logistics career fields more knowledgeable of their role in planning and executing wartime operations. Feedback from the first two classes indicate the course is on the mark and provides an excellent experience for logisticians at all levels of command.

The ten-day course briefly covers the history of logistics, discussing what was done right (and wrong) in World War II, Korea, and Vietnam. Other conflicts, including the Arab-Israeli Wars, the British experience in the Falklands, and the American action in Grenada, are examined to see how current logistics support operates in limited conflicts. Procedures and capabilities in maintenance, supply, logistics C^3, strategic mobility, and other areas are also examined, along with the Air Force's role in the AirLand Battle and the operating environment logisticians can expect at various levels of conflict from terrorist activity through nuclear war. The accent is on current capabilities and realistic appraisals of how the system will really work.

In the second week, the course covers contingency planning and the interactions of the JOPS, JDS, JDA, and the USAF planning process. Again, the focus is on a realistic appraisal of existing systems and their capabilities. This block includes a nine-hour planning exercise during which student teams build their own bare base deployment package and then analyze and resolve transportation shortfalls. Guest speakers from HQ USAF address Soviet Logistics, multi-theater conflict, and the Soviet Threat. The course concludes with a 2-day look at the future of logistics, logistics long-range planning, and the operating environment expected for the next 5 to 20 years.

The course is open to officers, senior NCOs, and civilians in any logistics discipline, from any command, and at any level of command. For additional information, contact Maj Dennis Dragich, Course Director, LOG 066, School of Systems and Logistics, WPAFB OH 45433-6583, or call AUTOVON 785-4149/4017.

AFIT Programs to Prepare the Logistics Generalist

The School of Systems and Logistics at the Air Force Institute of Technology (AFIT) has made several changes to its graduate and professional continuing education programs in logistics to develop the logistics generalist needed now and in the future. Along with the new Logistics Career Development Plan (LCDP) and the Logistics Civilian Career Enhancement Program (LCCEP), these curriculum changes foster a broader look at the entire logistics field rather than specialization in functional areas.

For example, the graduate logistics management (GLM) program offers a master of science degree in logistics management to Air Force military and civilian logisticians and provides its students a common set of background and tool courses as well as a common set of logistics core courses. These core courses cover maintenance and production management, distribution, contracting and acquisition, and a broad-based overview of logistics from a systems perspective. There are five majors, or options, within the program, the largest of which in terms of students is the general logistics management option. The number of options has declined in the past few years from seven to five—logistics management, transportation, supply, maintenance, and contracting and manufacturing. Students in these options are being educated to fill specific functional area positions coded as requiring an advanced academic degree. The curriculum for each option contains only 3 option-specific courses out of 22 total courses (9 credit hours out of 66 total credit hours) which distinguish one option from another. Thus, GLM students all "major" in logistics management and some "minor" in a functional specialization. In addition, two unrestricted electives allow further expansion of knowledge in logistics and the opportunity to complete a research thesis on a logistics topic.

Professional continuing education (PCE) is used by today's professional logistician to acquire and maintain an understanding of logistics concepts, policies, and practices supporting combat operations. During Fiscal Year 1986, almost 1000 logisticians selected from major commands and separate operating agencies will attend AFIT PCE logistics management courses designed to provide a generalist's perspective. They range from a four-week introduction to logistics course to a one-week course dealing with reliability. These short courses are in addition to an equal number of logistics courses directed at more specific educational needs. Several courses, such as Reliability Centered Maintenance, have been recently expanded to broaden the application and scope of logisticians. New courses, such as Combat Logistics, have been added to provide a more comprehensive understanding of how logistics is integrated into combat capability.

Whether assigned at unit level or at HQ USAF, today's logistics professional needs a broader understanding of the Air Force. AFIT's GLM and PCE programs seek to satisfy this need while providing a core of specialized courses.

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▶ *FROM 12*

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"The logistics progression is a system of links, and one must know how they interface. The system could be viewed as a pipeline. You cannot connect a two-inch pipe to a ten-inch pipe and expect a ten-inch flow out the two-inch end. It just won't work. But when properly managed, the interfaces between the links can provide logistics that will produce the intended flow."

Lt Gen Benjamin F. Register Jr.
Deputy Chief of Staff for Logistics, US Army

Coming in the Winter Issue

- **Combat Support Doctrine**
- **A "Short War" Strategy?**
- **Soviet Logistics**
- **Munitions Production Base**
- **Project "Broad Look"**
- **Tactical Forces Support**
- **"Logistics Needs" Program**

From the Wasteland of Experts—Back Through the Gateway of the Competitive Examination

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Introduction

The common residual intelligence is becoming impoverished for the benefit of the specialist, the technician, and the aesthete: we leave behind us the world of historical ironmasters and banker historians, geological divines and scholar tobacconists, with its genial watchword: to know something of everything and everything of something: and through the gateway of the Competitive Examination we go out into the Waste Land of Experts, each knowing so much about so little that he can neither be contradicted nor is worth contradicting. (24:160)

> ***"The trend toward specialization creates a dilemma not just for logisticians but for all military and business professionals."***

G. M. Young's despairing words from *Victorian England* are reflected in a modern-day challenge. Lieutenant General Leo Marquez, Air Force Deputy Chief of Staff for Logistics and Engineering, HQ USAF, has asked senior logisticians to consider ways to broaden the general logistics knowledge base of professional logisticians and to guard against structuring logisticians into narrow vertical specialties. (19:8) However, the trend toward specialization creates a dilemma not just for logisticians but for all military and business professionals. The premium on depth of specialized knowledge means that professional breadth can be acquired only at some cost in one's primary field. (7:39)

I believe a lesson from World War II can provide a partial solution. "In the war of 1939-45 . . . science entered in a new way; scientific method was applied more consistently and deliberately to the use of weapons and the conduct of military operations." (10:119) This new way of looking at things was unique not only because of the planned, systematic use of the scientific method but also because of the pooling of scientific effort to solve problems. (8:341) Operations research (OR) teams of scientific and functional experts were organized to solve a wide range of tactical and strategic problems. After the war, a number of British Air Chief Marshals noted the great value of OR sections during the war and claimed OR would continue to be essential in a peacetime modern air force and OR habits of objective analytic thought would become an integral part of the training of professional warriors. (1:185)

Operations Research

There are many varied records of operations research and its methodology. Crowther and Whiddington (10) give one of the earliest accounts of the formal organization and activity of OR teams during World War II. Chacko (7) provides a unique discussion, which combines history and methodology, and references a variety of seminal accounts of OR that the British Admiralty published during the war. Trefethen (22) parallels the development of OR in Britain and the United States (US) and reviews military uses of OR after World War II. PoKempner (18) characterizes the evolution of OR in business in the postwar period. Finally, the OR methodology has been defined broadly in terms of approach, tools, and myriad applications.

Military Birth of Operations Research

Operations research was born in the British Royal Air Force. When war began in 1939, A. P. Rowe, Superintendent at Bawdsey Research Station, and Wing Commander R. Hart assembled the first formal OR section at Headquarters Royal Air Force Fighter Command. Initially, the group faced the problems of integrating the newly developed radar and the older Observation Corps methods of early warning of enemy air attack. Through experimentation and observation, the research section not only identified weaknesses in the system and recommended ways of improving radar operator techniques but also completed a comprehensive analysis of all phases of night operations and worked out tactics that played a decisive part in the Battle of Britain. (22:5)

In August 1940, General Pile, Commander in Chief of Anti-Aircraft Command, asked for assistance in the operational coordination of radar sets and anti-aircraft guns. (22:6) P. M. S. Blackett, noted British physicist and Nobel Laureate, brought together a small group of scientists to study the problem. "Blackett's Circus" consisted of physiologists, mathematicians, physicists, an astronomer, a surveyor, and an Army officer. (10:96) It was one of the first groups to recognize the need for close integration of scientists and service operational staffs and to emphasize the use of the analogical process of OR to ensure service command objectives and doctrines were applicable to the problems at hand. "Blackett's Circus" was the start of OR in the British Army. (5:89-91)

Operations research units spread rapidly. Blackett formed an OR section at Royal Air Force Coastal Command in March 1941. This section determined optimal depth charge settings and developed tactics for radar detection of ships and submarines. (5:95) In December 1941, Blackett was appointed Director of Naval Operational Research at the Admiralty and OR was started in the Royal Navy. A study of optimal convoy size resulted in logistics support essential to an Allied victory. (10:97) By the time the US entered the war, OR sections were active in all three British services.

In addition to his direct involvement in the start of OR organizations, Blackett hastened their spread by writing the first comprehensive expositions of OR. He wrote "Scientists at the Operational Level" in 1941 and, later, "A Note on Certain Aspects of the Methodology of Operational Research." These writings stated clearly what OR was and what it should do. Although secret, the documents received wide distribution and played an important role in the formation of OR groups in the three British services and in the Australian, Canadian, Free French, and US forces. (5:98)

As it had in Great Britain, OR spread rapidly in the US military. The first formal OR group was started at the Naval Ordnance Laboratory in March 1942. Before even being "formally" established, the group played a crucial role in the widespread aerial mining of Japanese-controlled waters. In October 1942, General Arnold recommended all commanding generals of Air Force commands begin operational analysis groups. Based on Air Force experience, General Marshall encouraged all theater commanders to start similar groups to study amphibious and ground operations. By the end of the war, OR teams had made countless contributions that included major roles in the aerial campaign against Germany and in the campaign in the Pacific. (22:12-20)

Definition and Essential Characteristics

The following definition was accepted by the Operational Research Society of Great Britain, which is a successor to the oldest professional OR society—the Operational Research Club:

> Operational research is the attack of modern science on complex problems arising in the direction and management of large systems of men, machines, materials, and money in industry, business, government and defence. Its distinctive approach is to develop a scientific model of the system, incorporating measurements of factors such as chance and risk, with which to predict and compare the outcomes of alternative decisions, strategies or controls. The purpose is to help management determine its policy and actions scientifically. (3:92)

The definition, which is based on an article written by Brown (6) in 1951, includes the essential characteristics of operations research; it is interdisciplinary, systems oriented, directed at assisting in the decision process, scientific in method, and prescriptive.

The scientific method is central to operations research, but it is not what makes OR unique. The interaction of the five essential characteristics defines the OR regime.

Hurni says that, "In its essence, the process of operations research is seeing an analogy between a given situation and some known logical structure." (13:235) Figure 1 shows Beer's illustration of the nature of the scientific model and reiterates the analogical thought process. (3:114) The model is ideally an isomorphism—a convergence or one-to-one correspondence of two system representations. One emanates from the operational realm, the other from the scientific realm. The importance of an interdisciplinary background for the OR team is first apparent in the need for sufficient familiarity with operational and organizational concepts to facilitate communication with the operators and to gain insight into the decision process. As the operational problem crystallizes, the analyst begins an analogous conceptualization. The similarity between the conceptual problem and the operational problem depends on the OR team's capability to draw innovative formulations from a vast array of disciplinary approaches.

System decisions represent a range from tactical to strategic. Ackoff offers three considerations:

> (1) The longer the effect of a decision and the less reversible it is, the more strategic it is; (2) the larger portion of a system that is affected by a decision, the more strategic it is; (3) the more concerned a decision is with the selection of goals and objectives, as well as the means by which they are obtained, the more strategic it is. (12:601)

OR has been applied widely and successfully at the tactical level where there is often a single well-defined objective. As the problem becomes more strategic, more system components become relevant and the need for interdisciplinary cooperation in understanding the diverse system components increases. Much of the future challenge for OR is at higher system levels.

Figure 1 also emphasizes the rigorous formulation of a model. The value to the decision-maker often depends on the conciseness, clarity, and accuracy of this model phase. Historically, OR has been characterized by a transformation from the descriptive and qualitative to the quantitative and causal.

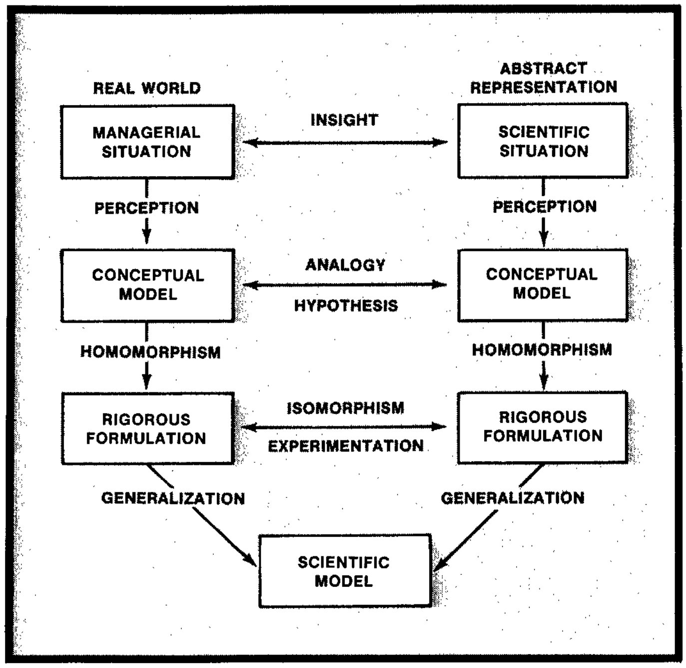

Figure 1: Scientific Model.

Seldom is the isomorphism ideal. Erroneous insights, poorly drawn analogies, and deletions of relevant components in an effort to quantify the system all lead to spurious results. Experimentation and empirical validation are the tests of the model. If the isomorphism is imperfect and the degree of accuracy not acceptable, the analytic procedure needs to be repeated.

Most important, OR results are prescriptive. They are dependent on descriptive assumptions and the following warning is ever present:

> The mathematical methods do not claim to provide answers to problems. They merely state that if the problems can be put into certain mathematical forms, then the answers are those provided by the method. The caveat "if" is sometimes overlooked, leading enthusiasts to claim that their solutions are what decision-makers should rely upon, while the method may not at all be applicable to the problem. (7:26)

The positive or normative interpretation of the results rests with the decision-maker. The results may reflect simply what

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is or would be based on the premises of the model. Such a positive or descriptive interpretation is quite different from a normative view, which accepts the results as the course of action that "ought" to be followed based on a judgmental view of the premises of the model. In either case, model results cannot supplant management decisions.

Operations Research Today

After the war, the character of OR began to change. The two principal reasons for the change were the growth of nonmilitary applications of OR in business and government and the development of OR as a "specialty." Crowther observes that "original operations research in the Second World War sprang from the struggle for national survival. While it recognized the methods of economics . . . [it] did not reflect market language and thinking." (9:310) One of the pioneers of OR, J. D. Bernal, concludes that OR "has been annexed to scientific management and in the process has lost its independent normative status." (4:805) Practitioners found it increasingly difficult to differentiate OR from other systems science "specialties." OR was defined in terms of its tools instead of its analytic process. (17:2) This narrow definition led to the evolution of management science. (23:233) Today, operations research, management science, industrial engineering, systems engineering, and systems analysis continue to struggle for separate identities. (14)

A Look At Business

PoKempner's 1977 survey of industrial and service firms and of managers of units doing management science (operations research) work shows OR in transition. (18) At first, business applications of OR spread slowly when compared to the growth experienced in the military; from 1955 to 1964, there was a rapid acceleration in the growth of new OR units; and from 1965 to 1976 the growth continued, but at a slower, more even pace. OR units were usually started to confront serious, pervasive, or unusual problems. Most often, chief executive officers initiated OR units, although finance officers and directors of support activities also started many OR groups. By 1977, OR units were dealing successfully with a wide spectrum of problems from inventory management to strategic planning. However, the most often mentioned strength of OR—comprehensive examination—stands juxtaposed to the most frequently mentioned weakness—narrowness (defined as limited repertoire of techniques).

The change is clearly indicated by the composition of OR units and the OR managers' view of the future. While senior OR practitioners usually had hard science or engineering backgrounds, junior practitioners were most often trained in the mathematics or the systems science specialties. Sixty percent of all OR units stood alone; that is, they did not include staff specialists. Most OR managers felt the ideal preparation for an OR practitioner would be a Master of Business Administration (MBA) with knowledge of quantitative methods or a degree in the systems sciences; e.g., operations research, industrial engineering, systems engineering, or management science. The ability to work alone was cited as the most important individual characteristic. Finally, most managers of OR units felt the groups should be "completely separate."

The minority views of a few managers of OR units may have foreshadowed future business needs. Some said they sensed a movement away from a concentrated education in majors like management science. The Chief Executive Officer of a major management consulting firm reported, "that professionals who have had either basic or additional training in a field of theory . . . seem to have superior problem-defining competencies and are more effective at getting to the heart of obscure, unstructured problems." (18:46) A few OR managers believed the ideal unit consisted of individuals assigned for fixed periods on a rotating basis, who returned to functional areas after leaving the OR unit.

In the mid-1970s business leaders became interested in "matrix organization." Although the principal motivation for this interest was dissatisfaction with the inability of traditional functional and divisional organization structures to deal with complex problems, some executives felt the matrix organization provided a better management progression for individuals—one that offered a smoother transition between functional jobs and general management positions and that exposed functional specialists to other specialties and to business concerns. The matrix approach was an outgrowth of the experiences of industrial relations, aerospace, and defense firms that had been successful in combining skilled individuals from a variety of specialties into "project teams." The key difference in the matrix concept is it applies to permanent as well as temporary work. However, to many business executives, "matrix organization" was any device that coordinated work across unit boundaries or that allowed peers to work together; e.g., task forces, coordinating committees, leaderless groups, etc. The record of success and failure in implementing matrix organizations is mixed. (16)

Based on a June 1984 survey of a selected sample of chief executive officers from among the 1,200 largest companies in the world, as well as interviews and small-group discussions with senior corporation executives, Janger (15) concluded that senior executives are demanding a more adaptive management system to deal with today's competitive, turbulent, and unpredictable business environment. The management system needs to be sensitive to change, flexible enough to respond to opportunities that come with change, and resilient to mistakes. Janger notes a number of companies have turned to something called the "business-team" concept to provide increased flexibility:

> What is said to make the business-team different from many earlier and more informal approaches to matrix organization is its greater structural formalization: the clarity with which individual and group assignments are made, the specificity with which responsibilities are delegated and accountabilities defined, and the way individual reward is tied to team performance. (15:11)

However, it is too soon to conclude that the business-team approach will become widespread or substantially different from matrix organization.

"What individual qualities allow a specialist to step beyond a narrow, traditional view and to attack successfully more complex issues?"

The Problem at Hand

The historical record of the successes of OR and repeated business emphasis on "team concepts" underscore the

potential value of teams of specialists in solving tactical and strategic problems. A more basic question remains: What individual qualities allow a specialist to step beyond a narrow, traditional view and to attack successfully more complex issues?

H. A. Sargeaunt (20), who was one of the early heads of the British Army Operational Research Group that evolved from "Blackett's Circus," described the characteristics that should be taught to members of OR teams. Sargeaunt believed the fundamental skill that must be taught was the ability to put oneself in the place of the executive making the decision. An individual must learn to recognize when a decision requires a certain course: taking immediate action, asking the right questions, observing patterns of behavior, or some other alternative. With this skill as a basis, an individual can learn to determine when and where a certain form of analysis is relevant, to include only details essential to a solution, to collect facts quickly, and to simplify presentations of alternatives. Practice and enthusiasm for the OR method are the key ingredients for learning these skills. Finally, Sargeaunt felt that two additional characteristics could be developed under the tutelage of a good scientist: a scientific sensibility or a "nose for the problem" and a character or behavior that would allow the "thrust and parry" necessary when corroborating with others.

The theme that "executiveship" is the capacity that enables an individual to step out of the realm of specific experience and deal with a wide spectrum of complex issues is repeated in Dawkins' views on post-commissioning officer education. (11) He says that an "integrative experience" is one of the three methods of officer education vital to coping with growing specialization, expanding officer roles, and increasing complexity of leadership and management. Executiveship is the consequence of developing a thought process oriented to solutions. Dawkins concludes: "The most effective way of developing this outlook is not by surveying a broad range of subjects, but by learning enough about a discrete field . . . to show its historical basis, fundamental principles, current applications, relationship to associated fields, and to be aware of competing concepts and interpretations." (11:160)

In summary, a partial solution to the dilemma created by increasing specialization may be to ensure all Air Force professionals have a sufficient understanding of systems science and of classical methods of scientific thought to be both aware of and interested in the integration of their individual subspecialty with the components in a larger system. The educational objectives developed by the Advanced Research Institute on Education in Systems Science under the auspices of the NATO Science Committee's Special Programme Panel on Systems Science can be a guide. These objectives emphasize the motivation of the need for systems science and the development of the systems science process—not techniques. These objectives are:

(1) To generate a need for Systems Science by recognizing that today's problems are of longer range, have greater criteria dimensionality, include more intricate interdependencies, and involve greater uncertainty than non-Systems Science specialists' current approaches admit.

(2) To emphasize the compatibility between the individual's current analytical process/values/constraints/forecasts and the Systems Science approach.

(3) To feel it can be fun (intellectually and productively) to be part of a Systems Science effort.

(4) To recognize that Systems Science is a way of looking at and/or developing alternatives without getting lost in the complexities of the problem.

(5) To understand that the role of analysis will vary with the problem attacked and to focus on the "message" of the analysis rather than its numerical output.

(6) To understand that insight (but not necessarily answers) can be provided by Systems Science.

(7) To be able to interpret the output but not necessarily the details of the mechanics; that is, to be educated users.

A Final Note

The lessons of World War II show the planned, systematic application of science to problems of tactics and strategy is not inconsistent with leadership and initiative:

> . . . Hitler . . . had a romantic view of war. He believed that wars are to be won by great strokes of inspiration. Systematic scientific work on known weapons paid larger and quicker dividends. It beat Hitler. The romantic concept of war is becoming out of date. It is not consonant with the systematic, rational, scientific kind of war which is evolving from the inter-penetration of war and science. It is incompatible with the exercise of mystic qualities of leadership and initiative. (10:119)

Fighting spirit and analytic ability can be embodied together in the military professional. Concern about the abuses and misuses of analysis (21) and the current deemphasis of management should not result in a deemphasis of the prescriptive application of the scientific method to war or be a return to the more romantic notion of war.

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Combat Support Research & Development

The year is 2000 and the place is somewhere in the Mideast. A damaged Air Force fighter aircraft limps back to base after a hot engagement. The aircraft vectors towards an auxiliary field pressed into service when the main operating base's main runway was bombed. The auxiliary field has also been damaged, but there is a usable 2000-foot strip remaining. Because of some logistician's foresight 15 years ago, the aircraft is using reconfiguring flight controls and a bidirectional engine nozzle to land precisely on that precious 2000 feet of runway. Since the taxiways have not yet been repaired, the ground crew slips an air-cushioned transporter under the wounded aircraft. Within minutes the aircraft has transversed the rough terrain to the maintenance area.

Since the aircraft downlinked its avionics health from the on-board diagnostics systems, the maintenance expeditors are waiting to remove and replace the nonworking subsystem modules. The battle damage repair assessor is waiting with his portable computer. By using a light pen on the computer graphics display, he is able to isolate the damaged aircraft locations. Within minutes the Chief of Maintenance knows how many people of each specialty will be needed and how much time it will take to return the aircraft to operational use. Long shelf-life adhesives, common avionics modules, graceful degradation of subsystems, on-board reconfiguring flight-controls, and advanced aircraft design enhance sortie generation turn rates. These advances, plus the virtual elimination of ground support equipment and a massive reduction in the number of regular maintenance actions, have provided the Air Force the capability of magnifying the apparent number of aircraft available for wartime sorties. Freed from the traditional support structure, the Air Force of the future can operate effectively from remote, limited airfields.

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Whether such a favorable scenario reflects an accurate view of the future, or just wishful thinking, depends largely on how well the Air Force articulates logistics-related research and development needs and applies new technologies to actual weapon and support systems. The transfer of innovation from the laboratory to the flight line is called "technology transition." The process is complex, often fragmented, and difficult to understand and access by practicing logisticians seeking help on concrete problems. Through this new department, *AFJL* will strive to inform potential users about research and development (R&D) organizations, processes, players, and outputs, so they can become active participants in applying up-to-date solutions to pressing design and production challenges.

Our first article, appearing next issue, will explain the "Logistics Needs Program" through which logistics problems are identified, prioritized, and passed to appropriate R&D organizations for resolution. Subsequent articles and briefs will focus on both the R&D process and new available capabilities.

OBOGS: A Transitioning Technology

The on-board oxygen generating system (OBOGS) applies proven molecular sieve pressure swing absorption technology to replace on-board liquid oxygen as a source of breathable gas for aviators. In layman's terms, it provides oxygen from engine bleed air. This technology holds great promise for both logistical and war-fighting improvements. It reduces the aircraft logistics burden by eliminating the need for resupply of liquid oxygen (LOX) or high pressure gas. Improved supportability and mobility, increased aircraft availability through reduced turnaround time, and reduced maintenance tasks are direct results. Eliminating LOX means a safer maintenance working environment. The technology also reduces aviator aeroatelectasis and middle ear/sinus discomfort experienced with current oxygen systems. Both the Air Force and the Navy are employing OBOGS technology on systems in development and/or production. The Navy has included OBOGS as a baseline requirement for the AV-8B, T-45Ts, and MV-22 aircraft and is planning to eventually place OBOGS in all carrier-based, front-line tactical aircraft. As a first step, the Navy plans to include OBOGS in FY89 F/A-18 and all F-14D/A aircraft. Air Force efforts to realize the benefits of OBOGS technology include an operating molecular sieve oxygen generating system (MSOGS) on the B-1B, an R&M 2000 initiative to insert OBOGS into the F-15E in FY89, an Aeronautical Systems Division, Life Support System Program Office (ASD/AE) program development of an MSOGS that meets the advanced tactical fighter's requirements, and an evaluation by AFLC and AFSC of retrofitting current USAF aircraft with OBOGS. An OBOGS, built by Clifton Precision Instruments and Life Support Division, has been flying in an F-16A engineering test aircraft at the Ogden Air Logistics Center since Aug 82. The results, after more than 200 flights and 300 flying hours, have been excellent. OBOGS technology will enable the services to eliminate the requirement for LOX and its generating plants and support equipment. (Lt Col Jim Garlitz, AF/LEYYC, AUTOVON 227-4377)

USAF Logistics Policy Insight

Rapid Deployment Aid

The Air Force and the Department of Defense need an automated capability to support rapid deployment of US Forces from CONUS installations and to provide accurate and timely data to manage the total deployment process. Transportation module (TRANSMOD) is the Air Force's initiative to develop an automated system which will provide this capability for mobility transportation functions during both peacetime and wartime operations. As a feeder system to the joint deployment system, major commands, and transportation operating agencies, TRANSMOD source data will significantly improve the quality and timeliness of information available for planning, coordinating, and executing the overall crisis action deployment management system at all levels. TRANSMOD will specifically zero in on automated means for load planning, manifesting, and shipment document preparation such as bills of lading and man/machine readable labels/special handling forms. Implementation of TRANSMOD at each CONUS installation/base hosting deployable Air Force units is our goal. Efforts are now underway to develop a program management directive (PMD) for TRANSMOD and preliminary work has begun on writing the functional description.

Austere Base Fuels

Project PETROL READY is the special identification applied to initiatives in the fuels functional area that involve improvements in supporting and sustaining forces in a bare/austere basing environment. While many of the initiatives are specifically directed at fuels/cryogenics equipment programming, procurements, and upgrades, the planning aspect is also addressed by PETROL READY. In this regard, a capability assessment technique for base fuels operations, designated RCAM (Refueling Capability Assessment Model), has been developed. RCAM provides a medium to identify limiting factors, validate basic fuels planning parameters, and optimize deployment package configurations. RCAM is expected to be particularly valuable in bare base planning where fuels support is to be provided by a combination of deployed and inplace assets. While still in a quasi-validation stage, RCAM holds much potential for improving fuels planning.

Electronics Reliability Measures

In Jul 85, the Vice Chief of Staff approved a new policy to employ harsh environmental stress screening (ESS) to increase the reliability of electronic equipment. Harsh ESS uses thermal shock, random vibration, and moisture to test equipment at the piece part, assembly, and system levels. The benefits are reduced infant mortality and fewer latent defects. Parts problems, poor workmanship, and process breakdowns are identified in the factory and not in the field. The Vice Chief of Staff also approved an electronic parts policy to improve reliability as a companion policy to the use of harsh environmental stress screening. By FY87, all electronic parts used in manufacture or repair of Air Force weapon systems will have at least a .999 probability that the part is good. Planning will be accomplished to increase the good part probability to .9999 in FY90. This policy will help provide avionics manufacturers with high quality parts to begin the assembly process. The *R&M 2000* Steering Group, chaired by the Special Assistant for Reliability and Maintainability and composed of Air Staff and acquisition command representatives, will provide guidance for both policies by Dec 85.

Tactical Nuclear Weapon Protection

The Weapon Storage and Security System is a new nuclear storage concept designed to provide greatly improved survivability, security, safety, and operational readiness for our tactical nuclear forces. Nuclear weapons will be stored with strike aircraft. The system includes a hardened underground vault with an associated command, control, and communications system to provide intrusion protection. It will be installed in tactical aircraft shelters at forward deployed locations. A prototype vault was installed and tested in Germany in 1982. Installation of operational systems is scheduled to begin in 1987.

Personal Property Automation

The Transportation Operational Personal Property Standard System (TOPS) is a DOD productivity project designed to provide standard automated operating procedures and equipment to CONUS personal property functions. TOPS will dramatically reduce the manual administrative workload associated with preparing, controlling, and distributing documents and maintaining registers, rosters, and files. By providing standard automated procedures and exploiting off-the-shelf computer equipment and software, TOPS will improve the coordination and control of personal property movement and storage and enhance the depth of quality control and management information. The system is being developed by the Department of Energy's Oak Ridge National Laboratory in collaboration with the military Services and Military Traffic Management Command. Prototype testing will begin in FY86 at selected sites with full implementation scheduled for FY87.

Spares Provisioning Policy

New guidance has been issued to establish policy and responsibilities for initial spares and repair parts provisioning. AFR 800-36, *Provisioning of Spares and Repair Parts,* 11 June 1985, which applies to all activities involved with the provisioning process, incorporates many of the Air Force Management Analysis Group (AFMAG) recommendations for improving the provisioning process. A provisioning strategy and an integrated spares acquisition and support plan are now required for each acquisition, as is using a logistic support analysis (LSA) to identify requirements.

Spare Parts Pricing

The Air Force is conducting a test of how we price and pay for contractor support and services when procuring spares and support equipment. This is part of an on-going coordinated effort by AFSC and AFLC to highlight support and service costs for rigorous analysis and cost reduction. Resulting policy changes should be implemented.

Excellence Program Expanded

The Logistics Excellence Program (LEP) was recently expanded to include two bases in SAC (Carswell and Grand Forks AFBs) and two bases in ATC (Columbus and Williams AFBs). LEP, a two-year program designed to test streamlined and simplified logistics procedures, now encompasses eight bases representing five MAJCOMs. Approximately 80% of the initiatives generated by these bases have been approved and are being analyzed for implementation throughout the Air Force.

Most Significant Article Award

The Editorial Advisory Board has selected "Avionics Reliability—The War We Are Winning" by Jerry D. Schmidt as the most significant article in the Summer issue of the *Air Force Journal of Logistics*.

A Case Study: PEACE VECTOR I (Sale of 40 F-16s to Egypt)

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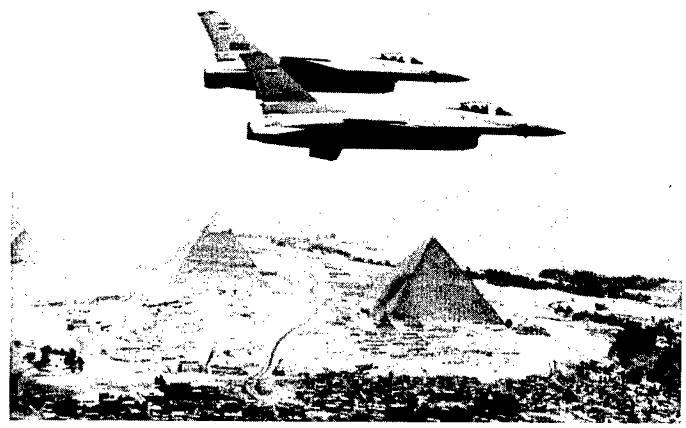
Background

Beginning with the Camp David accords of September 1978, the United States Air Force (USAF) embarked on an ambitious security assistance program with Egypt. This program was designed to modernize Egyptian Air Force (EAF) equipment and demonstrate United States (US) willingness to provide Egypt equipment similar to that provided to Israel. While the overall US effort was geared toward upgrading all elements of the Egyptian military, the EAF received most of the early attention. Front-line jet fighter aircraft are among the most glamorous of the world's arsenal of weaponry; thus the Government of Egypt placed top priority on immediate purchase of front-line US fighter aircraft. The F-5 "Freedom Fighter," which had been sold to many of our allied countries under the security assistance program, seemed a logical candidate in terms of meeting the EAF's operational needs and support capabilities. The F-5, however, was not a front-line US fighter and thus clearly did not have sufficient prestige to be a serious contender in the new post-Camp David relationship. The Egyptians were interested in the F-4E, F-15, and F-16 from the very outset of this new relationship.

"This was by far the most rapid sale, delivery, and operational demonstration of a major weapon system ever accomplished by the US Government."

In August 1979, the US and Egypt signed a letter of offer and acceptance (LOA) for the sale of 35 F-4Es from USAF inventory to the EAF under the project name of PEACE PHARAOH. The first increment of F-4Es was delivered to Cairo West Air Base, Egypt, in September 1979, and participated in a flyover for the Egyptian Armed Forces Day celebration on 6 Oct 1979. This was by far the most rapid sale, delivery, and operational demonstration of a major weapon system ever accomplished by the US Government.

During this same period, the US and Egypt signed an LOA for sale of 40 F-16A/B aircraft to the EAF under the project name of PEACE VECTOR. The total value of the LOA, which included all necessary support equipment, two years' supply of spare parts, technical data, training, USAF and contractor support teams, an F-16 flight simulator, and upgrade of facilities at An Shas Air Base, was $935 million. The embryonic PEACE PHARAOH program was already experiencing serious support problems, which demonstrated substantial support infrastructure improvement was needed before introducing a sophisticated fighter aircraft to Egyptian



soil. Once again, however, political considerations prevailed and the F-16 deliveries were targeted to begin in March 1982, 21 months ahead of normal lead time. During the last week in March 1982, the initial six F-16s landed on schedule at An Shas Air Base, approximately 30 miles northeast of Cairo. Deliveries proceeded at a rate of three every other month, culminating in the final PEACE VECTOR I delivery on 12 December 1983, one month ahead of schedule. By the last aircraft delivery, all facilities were complete and an active flying and maintenance training program was in progress under the technical guidance of an in-country 130-man USAF and contractor technical assistance team. The EAF demonstrated the progress they had made on their F-16s in a very successful participation in the Joint Exercise "Bright Star" in August and September 1983.

On the surface, at least, PEACE VECTOR was a spectacular success. It is both useful and interesting, however, to delve a little deeper and see what types of problems had to be overcome, what problems are still impacting the program, and what the prospects are for EAF self-sufficiency in the foreseeable future.

Problem Areas

Delivery Schedule

Early delivery of their newly purchased F-16s was an overriding concern to the Egyptians from a political standpoint. Little attention was paid to the advertised 42-month aircraft production lead time or the need for at least that much time to prepare facilities, lay in spares and support equipment, and train support personnel. The question of the moment was: "How fast can the US get F-16s on the ramp at An Shas?" While some acceleration in delivery schedule can normally be achieved by providing incentives to the

Colonel Olds wrote this article when he was assigned to the Mid-East Africa Division, Directorate of International Programs, HQ USAF, Washington, D.C.

manufacturer, the Egyptians were clearly not interested in just "some" acceleration. They were after a major speedup, and that meant diversion of aircraft intended for the USAF inventory. The staffing for that proposal was extensive, involving Tactical Air Command (TAC), Air Force Systems Command (AFSC), Air Force Logistics Command (AFLC), and numerous elements of the Air Staff. The final agreement called for delivery beginning 21 months after LOA signature, only half the standard lead time. This schedule dictated that 30 F-16s in the production line be diverted from the USAF to Egypt, with payback at the replacement cost later on in the F-16 production run.

Every increment of the accelerated aircraft delivery schedule was achieved on or ahead of schedule. This was a major achievement under the circumstances, thus a potentially significant political impact was averted.

"As is often the case in a "push" supply system, knowledge of overall stock levels was maintained only at the highest levels in EAF headquarters."

Supply System Interface

Interfacing the USAF's highly automated supply system with the EAF's manual system proved, and continues to prove, to be a major hurdle in the program. The EAF supply system, as it existed when the USAF security assistance effort began, was almost totally incompatible with the USAF system. Documenting demand rates, computing stock levels, ordering lead time away from need date, orderly warehousing, repair cycle management, and budgeting for follow-on support requirements were simply not done in the EAF in a form that was compatible with the USAF system. In addition, a number of EAF supply policies which were rooted in tradition or law created extensive problems:

a. Many EAF supply procedures were dictated by laws generated as a result of Egyptian experience with the Russians in 1972. When the Egyptians invited the Russians to leave, the Russians presented a bill for all materials provided and demanded immediate payment. The Egyptians could neither prove nor disprove the Soviet claims and, as a result, are now extremely concerned about accountability. Such supply transactions as providing a suitable substitute item, quantity errors, wrong parts shipped, and unit of issue changes created major difficulties in their accounting system.

b. Once EAF supply clerks signed for items, they practically became their owners. Getting those items away from them, regardless of how valid and demonstrable the need, often proved to be impossible. This situation was particularly acute when items were inadvertently delivered to the wrong base. When this happened, no one could simply process a routine supply transaction and pick up the items—even if plainly marked "F-16"—from the F-4 people. They had signed for the equipment and thus it belonged to them. USAF supply managers are certain that many of the spare parts which have been shipped to Egypt and never found are being faithfully stored at some inappropriate warehouses or bases.

c. The Egyptian supply requisitioning system was a laborious network of manual transactions requiring numerous validating initials and signatures before an order could be forwarded. As is often the case in a "push" supply system, knowledge of overall stock levels was maintained only at the highest levels in EAF headquarters. Supply personnel at the organizational levels did not have such information. When key players in the requisition approval chain were not available, the process was halted until their return.

Training provided by a USAF supply assistance team early in the PEACE VECTOR program barely put a dent in the problems. Thousands of items shipped to Egypt were never located at the need point. Often they were there, but nobody could find them. Sometimes they were found at another base, from which some were extricated. Other times there was simply no explanation—the items had simply vanished.

Early in the program, USAF logistics management personnel at AFLC's International Logistics Center (ILC), Wright-Patterson AFB, Ohio, initiated a two-phased project to automate the EAF supply system and enable it to interface more satisfactorily with the USAF system. The first phase was installation of a computer-based data-phone capability at the EAF supply depot at Basatin. This capability, which went into operation in October 1981, allowed the EAF to transmit requisitions directly into the defense automatic addressing system (DAAS). It also gave them an on-line capability to their shipping agent in Baltimore, so they could receive real-time reports of air and surface shipments departing the continental United States (CONUS). This system did not eliminate the laborious in-country processing of requisitions, but it was nevertheless a major step forward. As anticipated, top EAF supply officials were extremely reluctant to exercise the full capabilities of this new system, particularly where they saw their authority and control being diluted. For example, the system had an excellent capability to produce supply transaction status reports in a variety of formats for base-level use. EAF headquarters would not permit this for over two years because they viewed that function as an element of their control.

The second, and much more ambitious, phase of the ILC's automation initiative is the Integrated Logistics System (ILS) which will link by microwave all the sites involved in managing US weapon system programs and provide for an automated integration of the entire supply and maintenance transaction and scheduling system. Also, the software engineering for this system will advance the state-of-the-art of automated logistics management. If successful, it will give the EAF a truly superior management system. Will they use the system to its potential? We cannot say for sure, but achieving full usage is likely to be a long and frustrating process. The Egyptian philosophy of strong central control over decision-making is hardly compatible with a mechanized system which stands ready to make many of those decisions for an individual, or even worse, allow anyone with access to a terminal to make those decisions.

The supply system interface and internal EAF supply system are making steady, if not spectacular, progress. They remain, however, top echelon concerns. With the F-16C/D and the E-2C weapon systems preparing for entry into the EAF inventory, many problems will probably surface before the EAF supply system is fully capable of supporting American weapon systems.

Definitization of Spares and Support Equipment

Most security assistance program customers order and lay in their initial spares and support equipment under a process known as definitization. AFLC first generates a recommended list of all the items it believes the customer will need based on the best available information. The customer then reviews this

list and selects (or "definitizes") those items desired. Egypt, like many economically constrained nations, is extremely concerned about the high cost items. Definitization thus becomes an exercise in eliminating as many of the high cost items as possible. High cost items usually have a long lead time, so the consequences of underbuying these items can be quite severe. Another definitization problem concerns the different environments in which the US and Egyptians work. There are thousands of piece parts and other commodities readily available commercially in the US which are not spared by the USAF. In Egypt, however, most of those items are not available locally, and they can easily become showstoppers. During the early portions of US security assistance implementation, the Egyptians justifiably assumed the lists AFLC provided them for definitization included all their potential support needs. Their discovery (and ours) that there was a big void between what they needed and what was ordered was far too late to avoid a glut of equipment inoperable for lack of parts. EAF liaison officers have worked diligently with their AFLC counterparts to overcome this problem, and they have largely succeeded.

Transportation and Packaging

The Egyptian capability for moving needed parts and equipment through the pipeline was unsatisfactory, and while improvements have been made, the overall system is still inadequate. EAF bases did not have a packing and crating activity; thus it was common for reparables, some of them critical, to sit for weeks waiting for somebody to figure out how to properly package them for shipment. Once ready for movement, the scarcity of military vehicles caused further delays.

Facilities

The reduced lead time on the PEACE VECTOR I program imposed a severe constraint on the development of the facilities needed to support the F-16s. While some facilities were acceptable with little or no modification, most were not. The development of reliable electrical power and the establishment of effective water distribution systems, neither of which existed at the outset, were of primary concern. Next on the list were environmentally controlled facilities for the multi-station F-16 avionics intermediate shop, the jet engine shop, and the F-16 flight simulator.

Management of the needed construction was a fairly complex arrangement. Requirements generated jointly by EAF and USAF program managers became the responsibility of AFLC ILC to implement. The Center tasked HQ AFLC's Directorate of Engineering and Construction-International, who in turn tasked the US Army's Corps of Engineers for the major share of the work required. The Corps of Engineers typically contracted with appropriate architectural and engineering firms for design of the needed facilities, then contracted with building material and equipment manufacturers. Once the materials were in place at An Shas AB, the EAF hired Egyptian construction firms for the actual construction. As could be anticipated, the complexity of this network, combined with the aforementioned supply and transportation deficiencies in Egypt, led to countless problems:

a. Materials shipped and tracked through the shipping agent never arrived at their destination.

b. Identifying documentation was lost or rendered unreadable during shipment or unprotected storage in Egypt.

c. Materials were removed from uncontrolled storage stacks to fill a need somewhere else.

d. Critical items fell behind schedule during production in the US, causing entire projects to come to a halt.

e. Common tools and bit-and-piece construction items readily available in the US could not be purchased in Egypt and had to be ordered from the US.

f. The EAF temporarily ran out of construction funds and Egyptian firms simply walked off the job. (Most elements of the PEACE VECTOR I program were financed by a US loan to Egypt, but those funds had to be spent in the US. The EAF had to use in-house funds to pay Egyptian construction firms.)

Trained Manpower

Both USAF and EAF program managers knew from the beginning that one of the major hurdles to overcome in PEACE VECTOR I was the establishment of an adequate EAF work force in terms of both quantity and skills to support a sophisticated US weapon system. Those early concerns were not misplaced, as the manpower issue has plagued the entire program.

The plan to reach the desired work force objectives called for a cadre of EAF flight and support personnel to receive technical training in the US. The EAF rejected USAF recommendations that their personnel first receive English language training in the US, claiming they could provide personnel qualified in the language. After completion of CONUS training, the cadre would return to Egypt and form the nucleus of the F-16 operating and support force at An Shas AB. The sales agreement called for a 24-man USAF Technical Assistance Field Team (TAFT) and a 110-man Interim Contractor Support (ICS) team from General Dynamics Corporation. This team would reside in Egypt to provide on-the-job maintenance and supply training to EAF support personnel and flight training to EAF F-16 pilots. Both teams were scheduled to remain in Egypt for 18 months. In the meantime, the EAF would work through their Ministry of Defense to secure the increases in manpower authorizations needed to bring their meager manning up to a level consistent with mission requirements.

How did the plan work? Not so well. As of December 1983, when all the PEACE VECTOR I aircraft had been delivered, both the TAFT and the ICS teams were extended for an additional 18 months. As of July 1985, despite some drawdown in TAFT and ICS manpower numbers, both teams have been extended indefinitely. Conversion of EAF pilots to the F-16 was behind schedule, and no maintenance or supply shop was up to speed in terms of either quantity or technical skills of assigned EAF personnel. A variety of factors and problems contributed to the overall manpower shortfall:

a. The USAF and EAF agreed at the outset that all technical data provided by the USAF would be in English. This obviously meant that all F-16 support personnel would have to learn the English language. This was not a big problem with the EAF officers, as they were a very well-educated group of people. The enlisted force was quite another matter. Motivation to learn English among this force was very low, primarily because most of their terms of enlistment were only one or two years long. As more and more US systems enter the Egyptian inventory, the English language problem will become more and more acute. As of late mid-1983, the EAF has repeatedly been forced to cancel its slots in CONUS-based training courses and pay cancellation penalty fees because the

students could not achieve the prerequisite English language comprehension scores on their examinations.

b. Workday and attendance discipline in Egypt is considerably more lax than we are accustomed to in the US. Almost none of the EAF personnel live at their base of assignment and, with transportation at a premium, much of the day is spent getting to and from work. Effective training around such a workday was more of a challenge than the program could handle.

c. The EAF did not have a career force of highly skilled NCOs such as we in the USAF enjoy. Enlisted men received very meager wages and were not likely to reenlist. Enlisted tours of duty varied inversely with education credentials; the better educated a person, the shorter the service obligation. Most of the well-educated enlistees assigned to the PEACE VECTOR I program were placed into the supply organization. Their tour of enlistment was one year, which included their basic training time. TAFT advisors received about six months of work before losing the typical supply specialist. The lack of a career NCO force and the short tours of the new enlistees meant that training was far too heavily skewed to the entry-level end of the spectrum. Opportunities for training to the fully-qualified technician and supervisor levels were far too rare.

d. Since a trip to the US was considered to be a very desirable opportunity, the EAF tended to send their officers, instead of the enlisted men who would actually be doing the work, to technical training courses in the US. This had two unfortunate consequences. First, the EAF officers, for the most part well-educated engineers, were overqualified for the training they received. Second, the EAF enlisted technicians who actually did the maintenance work at An Shas got only a limited opportunity to receive very valuable training presented by USAF training centers and contractors in the US.

e. Pilot training was impacted by a number of additional problems. The EAF proved to be ultra-conservative in their flying restrictions. Both An Shas AB and alternates had to have good weather existing *and* forecasted, or no flights were launched. TAFT pilots were repeatedly frustrated by loss of flying days when the sky was perfectly clear over An Shas. The EAF also grounded their fleet of F-16s if they were alerted to a potential defect much more readily than the USAF did, and this also cost the pilot training program a significant number of lost sorties. Finally, the EAF lost one of their six F-16 B-models (the two-seat training version) and an instructor pilot in a crash in January 1983. That F-16B was a much more important aircraft than the single seat F-16As during the early phases of the PEACE VECTOR program, but the EAF elected not to replace it until much later in the program.

f. To compound the many problems plaguing the training effort, EAF program managers were unable to convince their Ministry of Defense that significant manpower increases at An Shas AB were essential to support the F-16. The EAF did not choose to share the details of their failure to obtain additional manpower with USAF officials, but we guessed three considerations played significant roles:

(1) Egypt was and is economically constrained, and manpower increase costs were unacceptable.

(2) The EAF used very small work forces to support their other jet fighter aircraft, most of which were provided by the Soviets in the 1960s. Those aircraft were far less sophisticated than the F-16, but that was very difficult for the EAF to explain to the Ministry of Defense.

(3) The Egyptian Air Force did not enjoy a very good professional reputation in the Army-dominated Ministry of Defense.

Follow-On Support Funding

The EAF's top priority during the early phases of their new security assistance dealings with the US was acquisition of new weapon systems. They needed new airplanes on the ramp so they could point to and show the world they were now a force with which to be reckoned.

Early in the PEACE VECTOR program, AFLC ILC presented detailed briefings to the EAF on projected follow-on support costs. But the lead time and dollar value elements of these presentations were probably not taken at face value by the Egyptians (indeed, it is difficult for USAF leaders to face up to those elements of our follow-on support requirements). They may have believed the Americans were exaggerating the cost and lead time estimates to give themselves a pad. As a result, the EAF delayed signing a number of their follow-on support LOAs and cancelled others.

The high costs and extensive lead times involved in supporting sophisticated weapon systems are unfortunate facts of life. The Egyptians have already had to spend over $20 million just to lay in spare parts to support the engines for their 40 single-engine F-16s, and those spares will not be delivered until 1986.

While EAF recognition of follow-on support requirements has improved somewhat, the problem has not been fully resolved. The Egyptian Ministry of Defense policy was to keep all funds programmed for follow-on support for all US systems (Army, Navy, Air Defense, and Air Force) under their control, doling it out to the services on a case-by-case basis as follow-on support LOAs were presented for signature. This made it nearly impossible for the EAF to effectively program for follow-on support in the out-years.

The Future

Where can we expect PEACE VECTOR I to go in the future? With the Egyptians continually pressing for more and more sophisticated weaponry to complement their new F-16s, we can anticipate a continuing US presence in Egypt for some time to come. A number of basic problems must be overcome if the Egyptians are to achieve the self-sufficiency they seek. Basic infrastructure problems must be corrected, adequate manpower must be obtained and retained, and the English language training programs must be strengthened and accelerated. Finally, a slowdown in the transfer of highly sophisticated weapon systems and accessories until the Egyptians can assimilate them would be beneficial. They have the capability and the will, but they appear too impatient to take the time. They should try to resolve basic problems before tackling new ones. We impose a greater risk to the excellent friendship which has developed between the US and Egypt if we provide them more than our combined efforts can handle.

Author's Note: Statements in this paper that describe Egyptian motivations, opinions, positions, and desires are not documented fact, but rather represent the author's understanding based on his close contact with the USAF-Egypt security assistance programs over three years. Readers should bear in mind that, regardless of the author's desire for objectivity, some degree of bias based on his view of the program from the Air Staff perspective may be manifest. This should not lessen the value of the paper as a planning aid for similar international logistics programs.

Displaying Combat Capability for Decision-Makers: The AFLC Sustainability Assessment Module

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Introduction

The Sustainability Assessment Module (SAM) is an integral part of the Headquarters Air Force Logistics Command (AFLC) Command, Control, and Communications initiatives—it provides logistics managers with the capability to assess weapon system wartime readiness and to indicate associated logistics resource shortfalls. SAM is one of the major functional elements of the weapon system management information system (WSMIS), whose goal is to provide system program managers (SPMs) with all the information necessary to monitor and control their weapon systems.

SAM's initial operational capability (IOC) is currently in the final implementation phase on the HQ AFLC worldwide military command and control system (WWMCCS) computer. The SAM IOC provides capability assessments for recoverable spares of six tactical weapon systems for 30-day combat scenarios. At present, users can interactively view assessment results on WWMCCS video display terminals.

Further, through an interface between SAM and the Intersite Command Post Communications Network (ICPCN), it will be possible to display SAM outputs on transparencies, cathode ray tube (CRT) monitors, and video equipment capable of large audience presentations. This interface has been demonstrated by processing a magnetic tape containing SAM outputs into an advanced technology multimedia communications (ATMC) environment. This environment will provide the vehicle for providing SAM assessments in an easy-to-interpret format to facilitate effective decision-making at all levels of operational commands and logistics communities.

SAM Overview

SAM is one of the major functional elements of the WSMIS. Figure 1 depicts the major elements of WSMIS. The goal of WSMIS is to provide all information necessary for SPMs to monitor and control their weapon systems. The combat logistics assessment subsystem (CLAS), including SAM, functionally provides all assessment information related to peacetime readiness, wartime sustainability, and the get-well plans for problem resolution. The process management subsystem (PROMS) will include the system engineering tools to provide information related to improved weapon system reliability and maintainability. The third key subsystem is the financial management subsystem (FINMAS), which will provide financial data related to weapon systems support budgeting. Most requirements and implementation efforts to date have been concentrated in CLAS, while PROMS and FINMAS have been only conceptually defined.

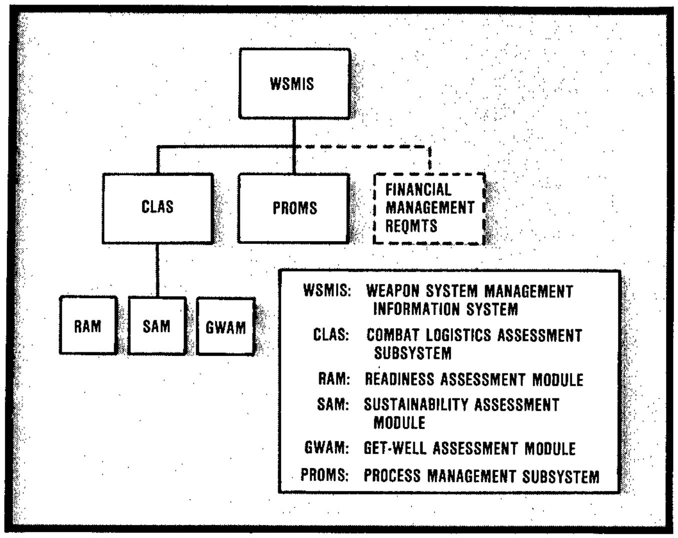

Figure 1: WSMIS Functional Overview.

The specific objectives of SAM are to predict sortie rates and aircraft availability based upon logistics resources and processes and to identify sortie-limiting logistics resources and processes. SAM meets these objectives by providing an automated analytic tool which processes input data from existing Air Force data systems and produces combat capability predictions and logistics limitations. These assessments are available to HQ AFLC, the air logistics centers (ALCs), and the major commands (MAJCOMs) through the AFLC WWMCCS Network and the WWMCCS Intercomputer Network (WIN). This information flow is shown in Figure 2.

The functional application of SAM within these various communities (SPMs, HQ AFLC, and MAJCOMs) can be identified as follows. First, the *SPMs'* responsibilities cover three areas: planning and assessment, system engineering, and program execution and monitoring. SAM can be used by the SPMs in all these areas since it provides capability predictions, high-driver identification, and alternatives assessment. Second, *HQ AFLC* responsibilities include the assessment of combat capabilities and the prioritization, allocation, and redirection of resources to achieve the best overall balance. SAM can be used in these areas since it provides weapon system status, inter-theatre status, and information necessary for resource and budget planning. Third, an important *MAJCOM* responsibility is the overall assessment of the resource posture and combat capability in each theatre. SAM can provide information necessary for this overall assessment through capability prediction, intra-theatre comparisons, resource allocation information, and operational planning information.

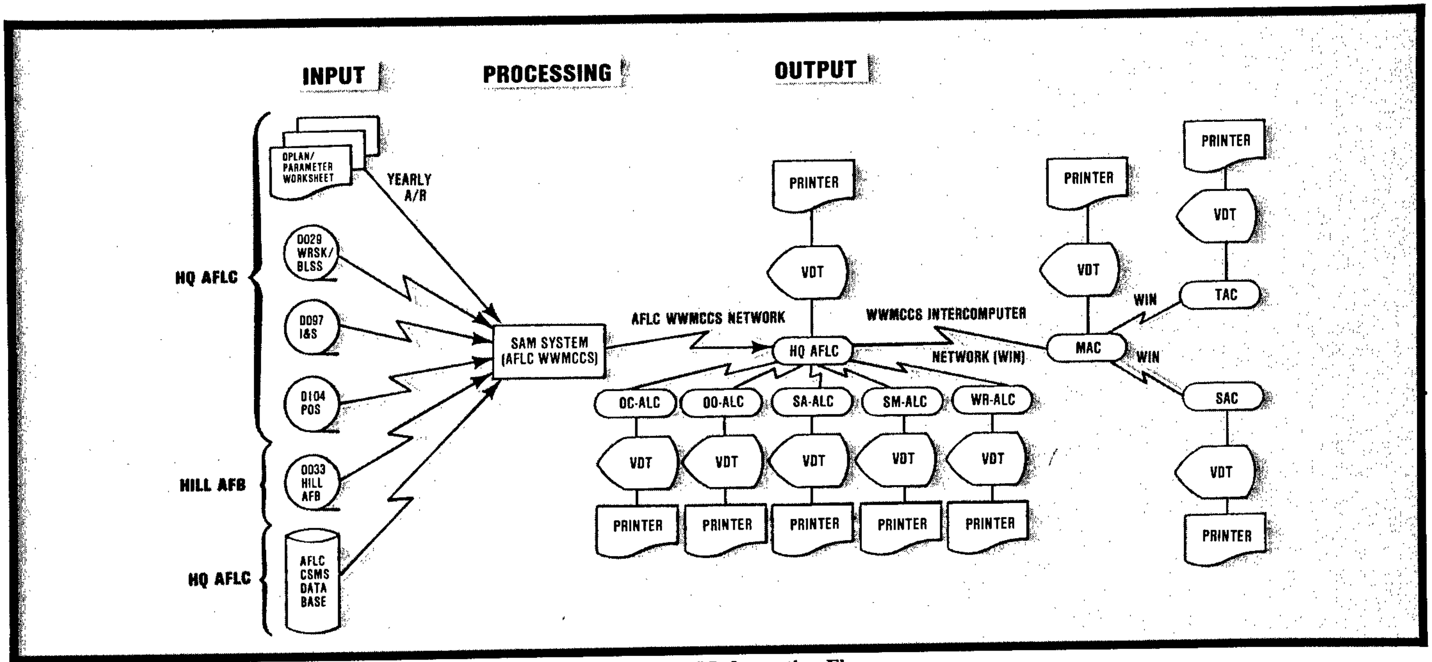

Figure 2: SAM Information Flow.

SAM Output Overview

The SAM output subsystem is driven by a menu-based system which allows the user to display wartime location or theatre outputs by aircraft type (MDS—mission design and series), scenario Operation Plan (OPlan), and output display type. The output display types consist of:

(1) An "echo" of the employment and deployment data used for the selected OPlan/MDS assessment.

(2) Fully mission capable (FMC) sorties and percent FMC sorties in tabular and graphical form.

(3) Not mission capable supply (NMCS) aircraft quantity and percent NMCS aircraft, in tabular and graphical form.

(4) Aircraft utilization rate ("turn rate") in tabular and graphical form.

(5) Problem parts listings.

Currently, these outputs can be viewed by users on WWMCCS video display terminals. However, this display technology does not lend itself well to viewing by large audiences or audiences in various locations. Thus, the ICPCN was suggested as the means for providing the AFLC with graphics capabilities necessary for displaying SAM outputs with high quality in a teleconferencing environment.

SAM/WWMCCS - ICPCN Interface

The ICPCN was developed by the University of Dayton Research Institute under sponsorship of the USAF Human Resources Laboratory and AFLC. It is designed to provide real-time teleconferencing and computer-aided color graphics in the form of hard copies, transparencies, CRT monitors, and video projection equipment for large audiences. The system is currently operating in AFLC and has been TEMPEST-cleared. The interface between the WWMCCS and ICPCN is by magnetic tape.

To date, the interface between SAM and ICPCN has been demonstrated by processing a magnetic tape containing SAM outputs into an ATMC environment and producing a high quality sample SAM output. The interface is shown in Figure 3, and the sample ATMC SAM output is illustrated in Figure 4.

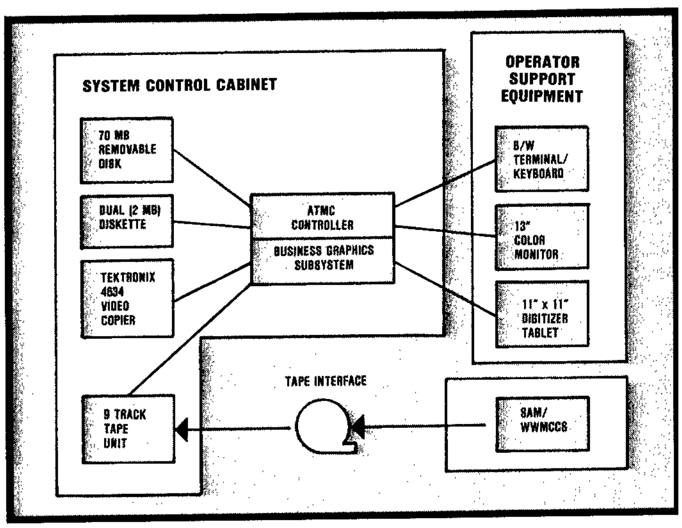

Figure 3: SAM/ICPCN Interface.

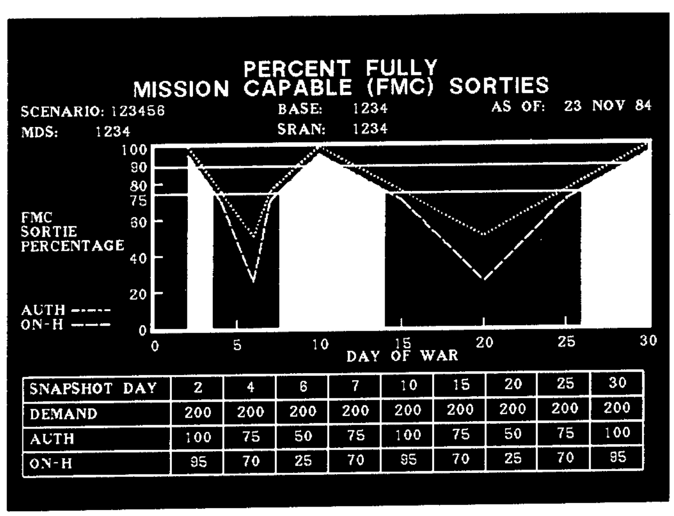

Figure 4. SAM Output Example Via ICPCN.

The ATMC is a conferencing system which consists of video, audio, and other support equipment capable of producing presentation-quality graphics with audio for local as well as remote audiences. The five forms of visual and hard-copy materials available through ATMC are business graphics, images (including freeze frame), handwriting over images, pointing, and printed pages.

Business graphics are produced by a high-speed color computer business graphics subsystem. Images are produced by an imaging subsystem capable of freezing frame images and capable of electronically writing over the frozen image. Pointing is accomplished by a visual cursor. Finally, printed pages are produced by a video copier.

Each conference location must be equipped with an ATMC system. A typical system configuration is shown in Figure 5. The most unique element of the ATMC system is the controller which is a microcomputer capable of controlling not only the teleconference itself but the peripheral devices used during the presentation. These peripheral devices include magnetic storage devices (removable disks and diskettes) for storing presentation slides, a color TV camera, color and black-and-white hard copy units, a digitizing tablet for presenter use, a large screen video projector, and a character printer for general use.

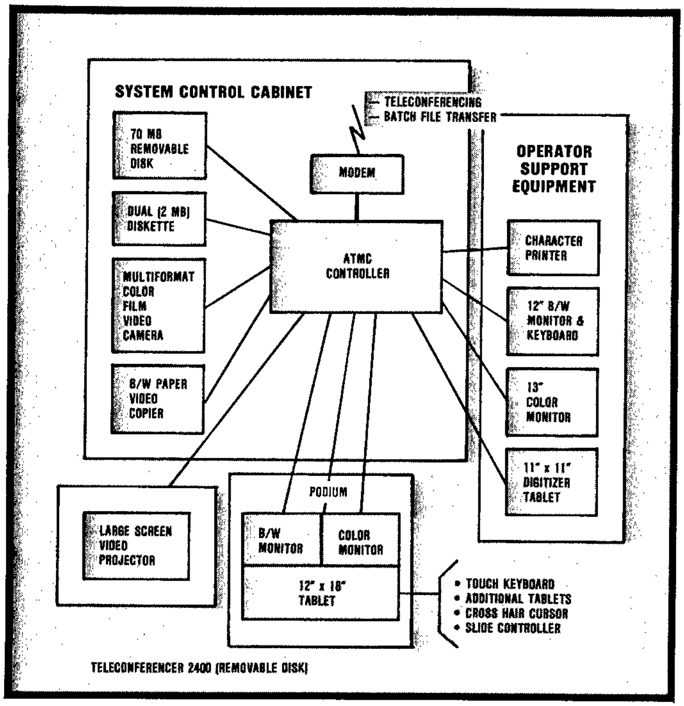

Figure 5: Typical ATMC Configuration.

Summary

The demonstrated interface between SAM and ICPCN has shown how important it is to present information vital to the overall assessment of weapon system sustainability in an easy-to-read and easy-to-interpret form to the appropriate Air Force personnel. This interface will facilitate decision-making in the areas of planning, assessment, and monitoring in which SAM plays an important role.

ICPCN can provide the means to produce SAM outputs in a high-quality graphics format for viewing by large audiences in various locations. This display and teleconferencing technology will become more important in the future as SAM is enhanced to include assessments for engines and engine spares, munitions, and other important logistics resources. These enhancements will result in a wider use of SAM, resulting in a large audience of SAM output products.

Currently, SAM is capable of generating combat capability assessments and logistics limiting factors in the form of simple graphics that can be viewed by a limited number of people. With the ICPCN interface, the usefulness of SAM will be enhanced and the SAM user-community and audience will be widened.

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Good Enough for Government Work

Franklin W. Jesser

"Good enough for Government work." When is the last time you heard that phrase? How long ago did you use it? More importantly, when is the last time you heard it used (or voiced it yourself) to refer to something that was of outstandingly *superior* quality? If your answer to the last question is a surprised "Never," you have lots of company.

It is time to turn the situation around. I would like to see the term, "Good enough for Government work," be reserved for only those actions and documents of the very highest caliber. In short, I would like to see this term become a laudatory rather than a derogatory phrase.

Reflect on one or two incidents in our past. Suppose, for example, the troops at Valley Forge had said, "Well, that's good enough for Government work" and gone home. What could have been the result? Conversely, what about the contractors who provided meat to those troops? They used this phrase in its worst sense. Fortunately, our troops eventually prevailed in spite of them, but don't you think the situation would have been better if those contractors had refused to sell any but the best provisions to the troops?

I am sure you can think of other instances in which attitudes and actions made a difference in past and recent history. I urge you to think of those situations the next time you are tempted to say or you hear, "Good enough for Government work." Consider the context; then ask yourself in each situation if the workmanship involved is truly of the *highest* caliber and indeed "Good enough for Government work."

Career and Personnel Information

Military Career Management

Support Officer Force Manning

We can better understand the composition and force dynamics of the logistics officer force if we first learn more about support officer force management. The support officer force is defined as those line officers performing duties in Air Force specialty codes (AFSCs) which do not *require* rated officers. Because rated officers perform duties in support specialties while in the rated supplement, they are a transient part of the support officer force (approximately 6%). Since the 1960s, pay caps, rated supplement drawdown and strength reductions requiring early-out programs/reduction-in-force (RIF), an upswing in the economy, and low support officer procurement following Vietnam have all shaped today's total line force.

Currently, support officer force net manning (authorized versus assigned, not including pipeline and transient officers) is 95%. This is an overall shortfall of over 2,600 officers. However, based on authorizations, this equates to an actual surplus of 5,000 lieutenants and deficits of over 3,300 captains, 3,000 majors, and 1,400 lieutenant colonels. The overall captain shortage is a reflection of major command (MAJCOM) established company grade (lieutenant and captain) authorizations which are not limited by law, as are the field grade authorizations (major and lieutenant colonel).

Low accession years in the middle 1970s will result in fewer new majors for the next several years, just as large accession years in the late 1960s will result in more lieutenant colonels being nonselected for promotion (although promotion selection rates will remain the same, the size of the year groups affects total numbers). Currently, 32% of the lieutenant colonel support officer billets are filled with nonselected or grade substituted majors and 45% of the major billets are filled with nonselected or grade substituted captains. This will continue for the near term.

Special assignment needs will continue to levy additional requirements on the overall support force. Selective crossflow of officers from all support specialties is required to fill critical needs and accession-producing specialties: Recruiting Service, Officer Training School (OTS), Reserve Officers' Training Corps (ROTC), Basic Military Training School (BMTS), Air Weapons Controller (AFSC 17XX), and Missile Launch Officer (AFSC 18XX). For FY86, 415 support officers will be drawn from their primary duty specialties to fill these career broadening requirements. The FY86 requirement is 106 lower than FY85, reflecting a reduction in dependence on selective crossflows.

Other career broadening opportunities will be offered to approximately 300 officers a year as Deputy Base Commander (AFSC 002X), Plans and Programs Officer (AFSC 007X), or professional military education and US Air Force Academy faculty. This is in addition to career broadening opportunities within individual specialties (aircraft maintenance and munitions, supply and fuels, etc.).

Examples of force dynamics affecting six specialties are:

(1) Space Operations (AFSC 20XX) will grow dramatically in FY86—nearly 200 more authorizations. Most will support the Consolidated Space Operations Center and will require officers with technical backgrounds. The Strategic Defense Initiative and a Unified Space Command will probably have unprogrammed requirements. Supporting these new requirements, while maintaining existing ones, will be a major challenge.

(2) Office of Special Investigations (OSI) (AFSC 82XX) manning has dropped from 100% to 86% over the past year, largely due to a 17% increase in authorizations to support fraud, waste, and abuse, and the counterintelligence program. The specialty is projected to reach parity manning with the rest of the support force sometime in FY86 through a combination of increases in accessions, technical training eliminees, and crossflows from other support officer career fields.

(3) Intelligence (AFSC 80XX) manning dropped from 98% to 88% during the past few years as a result of increased authorizations (23%—526 spaces) and a less than sustainment level of accessions. Again, manning is projected to rise to 94% by the year's end through an increase in accession and flight training eliminees, volunteers from other career fields, limitation of crossflow out, return of officers with prior intelligence experience, and growth in the number of rated supplement officers in the specialty.

(4) Logistics Plans and Programs (AFSC 66XX) authorizations have increased from 837 in 1976 to over 1,130 in FY85 and are projected to continue growing. Manning is below the logistics, as well as support officer, averages. The specialty has been traditionally a nonaccession career field (officers are crossflowed from another career field to the 66XX specialty). Although no lieutenant spaces are authorized, 40 accessions a year have been assigned to the career field since FY84—a practice which will probably continue in the future. This will help offset retention shifts and cyclic experience shortages.

(5) Comptroller (AFSCs 67XX/69XX/0056) specialties are experiencing severe field grade (major and lieutenant colonel) shortages, primarily due to low accession years following Vietnam and a significant number of mandatory retirements in the Audit Agency. Overall manning in the career field is increasing, but experience levels will remain relatively low.

(6) Engineering manning (AFSCs 26XX/27XX/28XX/29XX, 305X, and 55XX) has been a problem since 1979. We project overage manning of 103% by the end of FY85 due to a five-year program of increased accessions, implementation of a bonus program, and increases in AFROTC scholarships. To take advantage of the overages, engineers will be offered the opportunity to career broaden in selected support AFSCs to help alleviate shortages elsewhere in the support force.

Support force dynamics are strongly mirrored in the logistics force. Senior captains and field grade officer shortages will continue for the near term. Retention of these officers is essential to maintain the support force, as well as the logistics force, in the out-years. To project a realistic required force, a balanced authorization structure, for not only the total support force but each individual support specialty, must be maintained.

Source: Lt Col Edwin C. Humphreys III, HQ AFMPC, PALACE LOG, AUTOVON 487-3556.

OT&E Requirements for Contractor-Supported Software

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Many new and challenging logistics issues have accompanied the development and growth of Air Force software-intensive, mission-critical systems. Among these is the requirement for operational test and evaluation (OT&E) of software that is designated for life-cycle contractor support. Based on recent lessons learned, this paper supports the position that software documentation should be developed, delivered, and evaluated even if the software is to be contractor supported.

Background

The support concept for some emerging Air Force mission-critical computer systems dictates that software will be contractor maintained throughout the life cycle of the system. In such cases, there is often a tendency to claim there is no need for software documentation to be developed and delivered to the government and no need to evaluate the inherent supportability characteristics (maintainability and computer support resources) of the software. Rationale for these claims is a savings of acquisition funds, since the software supportability effort will be the contractor's concern. However, in the long run the Air Force becomes dependent on the developer and a savings may not actually be achieved.

Magnitude of Software Support

Almost all Department of Defense (DOD) weapon systems are critically dependent on proper and continued operation of mission-critical computer system software.[1] Software in tactical, strategic, command and control, and space systems encompasses millions of lines of complex computer code developed at a cost of billions of dollars. DOD's investment in mission-critical computer software was $3 billion in 1980 and is estimated to increase to more than $30 billion by 1990.[2]

Software support costs (after the system is turned over to the user) represent 70% of total software life cycle costs and are projected to increase to 80% in the next 10 to 15 years.[3,4] Figures 1 and 2 show the software life cycle and trends in software maintenance.[5,6] Software changes in mission-critical computer systems are nearly always unavoidable due to changing enemy threats and tactics, changes in user tactics, required improvements to system operation, the necessity to accommodate hardware changes, inadequate allowances for testing, and residual computer program errors. Figure 3 delineates the distribution of the software maintenance effort.[7]

Support Considerations

Programs encountering financial shortfalls during development usually experience cutbacks in various contract deliverables. Software documentation is often one of the first

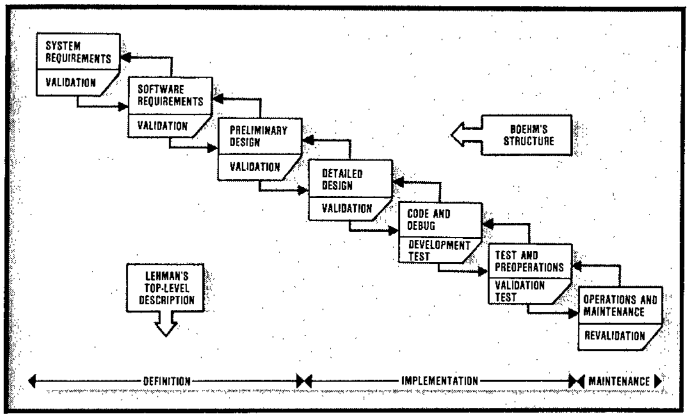

Figure 1.

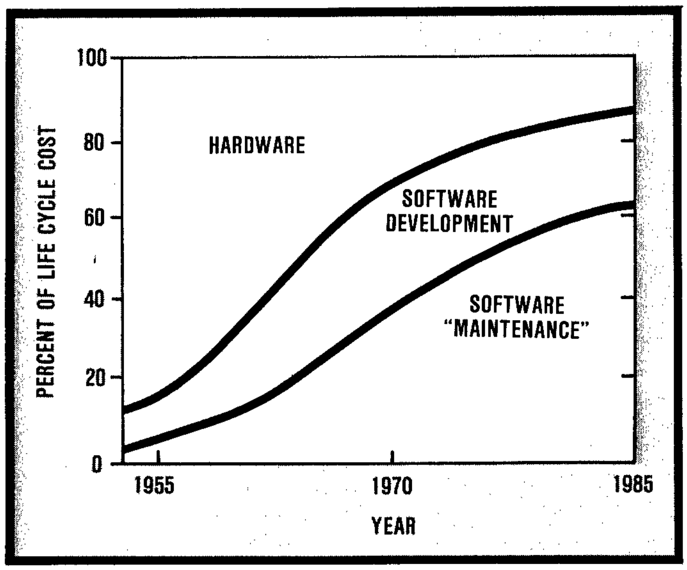

Figure 2.

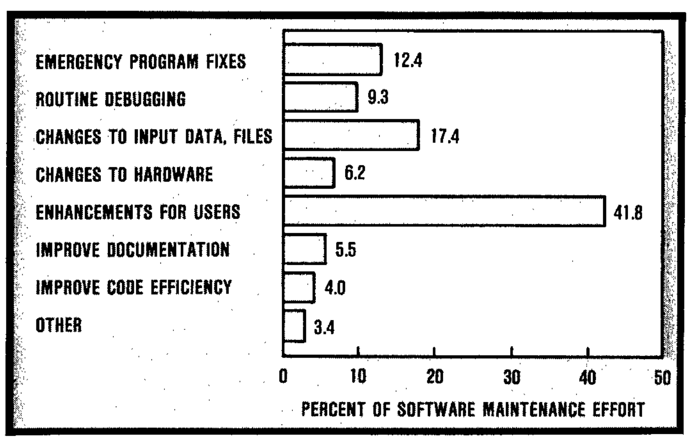

Figure 3.

items to be deleted from the contract in this situation.[8] However, because 70% of the total system software cost occurs during the maintenance phase, this may be a false savings since documentation is needed to maintain/modify the computer programs.[9]

Although contractor personnel usually write the software, the same personnel who write the software and the corresponding documentation probably will not maintain it past the developmental stage. System software designers are usually moved to other design efforts. Newly assigned and inexperienced personnel are normally assigned responsibility for maintaining the system software. These personnel will require quality documentation to understand the design and logic in order to meet existing and future user requirements and to implement them through software.[10] Since the individual who performs software maintenance must be capable of designing the software in the first place, the skill level and tools of the software maintainer must be as good or better than those of the software design engineer.[11]

There is a shortage of trained software professionals.[12] In fact, there is a projected 40% shortage of computer programmers by the year 1990. This, coupled with a 33% turnover rate per year among programmers seeking higher paying jobs, can be an even more critical support problem.[13]

Life cycle software support by the developing contractor is not guaranteed. The Air Force should ensure the government is in the position to recompete the software support contract should the need arise. Without the potential for transferring software maintenance responsibilities, the government becomes a captive customer. There is no bargaining power for enforcing better maintenance service. The government becomes a decision-taker rather than a decision-maker and there is no guarantee that the software will always be satisfactorily maintained. Contractors may go bankrupt and contractor personnel may quit or go on strike. Furthermore, the government (supporting or using command) may well assume software support responsibilities at a later date since support concepts are subject to change.

The quantity of weapon systems procured should not be a factor in the decision to perform software supportability evaluations. The same software change effort (design, integration, test, debug) is required regardless of the number of systems to be supported or who has software support responsibility.

Recommended Approach

During OT&E, the Air Force Operational Test and Evaluation Center (AFOTEC) uses a standard software maintainability questionnaire to evaluate representative software documentation and computer code source listings. For software scheduled for government software support, five software evaluators from the eventual software support facility are used to complete the evaluation. For software designated for contractor support, AFOTEC normally requests that the system manager from the supporting command provide these evaluators.

Software documentation and/or resources (facilities, personnel, computer hardware, support software, configuration management) should be evaluated during the OT&E phase and deficiencies corrected. If not, the user may field a system with unacceptable software supportability risks that equate to increased personnel and training costs and, decreased system readiness.

Air Force decision-makers require information concerning the life cycle software supportability aspects of emerging systems. Software supportability evaluations during OT&E are essential to provide this information and ensure the Air Force receives complete software documentation to support mission accomplishment. This applies even to systems scheduled for partial or total contractor life cycle software support.

For the reasons documented in this paper, computer software developed for the Air Force should be accompanied by complete and timely development and delivery of all required mission-critical software programs, documentation, and computer code source listings and their updates. This position is the same regardless of government versus contractor life cycle software support concepts.

Notes

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[5]Boehm, B. W. "Software Engineering," *IEEE Trans. Comput.*, Vol. C-25, December 1976, pp. 1226-1241.

[6]Information Processing/Data Automation Implications of Air Force Command and Control Requirements in the 1980s (CCIP-85), Vol. 1, SAMSO/XRS-71-1, February 1972.

[7]Lientz, B. P., and E. B. Swanson, *Software Maintenance Management*, Addison-Wesley, 1980.

[8]"JED Interviews the ASD Commander," *Journal of Electronic Defense*, July 1983, Vol. 6, No. 7, p. 40.

[9]Zelkowitz, Marvin V., Alan C. Shaw, and John D. Gannon. *Principles of Software Engineering and Design*, Prentice-Hall, Inc., 1979, p. 14.

[10]Berns, Gerald M. "Assessing Software Maintainability," *Communications of the Association for Computing Machinery*, January 1984, Vol. 27, No. 1, p. 14.

[11]McIlvaine, Paul J. "Software Logistics: A Sleeping Giant," *Concepts, The Journal of Defense Systems Acquisition Management*, Autumn 1982, Vol. 5, No. 4, p. 157.

[12]*Software Technology for Adaptable, Reliable Systems (STARS) Program Strategy*, Department of Defense, 1 April 1983, p. 6.

[13]McIlvaine, op.cit., p. 157.

Copies of the AFOTEC software maintainability questionnaire can be obtained from the Defense Technical Information Center (DTIC), Cameron Station, Alexandria VA 22304-6145. (Reference AFOTECP 800-2, Volume 3, 1 Jan 84, DTIC No. A153-465.)

(The author's recommended approach to software acquisition will be incorporated into AFR 800-14, *Acquisition and Support for Computer Resources in Systems* - Ed.)

"A force multiplier becomes a force divider if it is lost in combat."

Lieutenant General Leo Marquez
20 August 1985

The Air Freight Terminal Model: Easing the Bottleneck

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The ability of the United States (US) to deter aggression, limit conflict, and defend its interests depends on the capability to deploy forces rapidly and sustain them. While the capacity of cargo aircraft is small compared to sealift, its responsiveness and flexibility are crucial to effective delivery and resupply of troops. Consequently, a number of models have been developed to simulate delivery and resupply of forces. Unfortunately, most airlift resupply models represent air freight terminals as simply throughput nodes and assume they will meet the projected workload. This assumption is dangerous because it misrepresents the true nature of terminal operations. One result is that models used to build war plans do not consider airlift terminal limits, forcing aerial port managers to try to meet unrealistic objectives. Worse, actual resupply may fall far below projections if planners fail to recognize that an air freight terminal can be the biggest bottleneck in cargo flow due to the constraints of its internal operations. Insufficient numbers of forklifts, truck docks, 463L pallet pits, and people can cause long delays, severely reducing a terminal's throughput. To address this problem, the Air Force Logistics Management Center (AFLMC) developed a computer simulation that models the internal operations of air freight terminals. The terminal manager can use the simulation to determine wartime materials handling equipment (MHE) requirements; major command (MAJCOM) staffs can use it to develop more realistic war plans.

Background

The AFLMC initiated this project because the Air Staff Directorate of Transportation (HQ USAF/LET) and HQ Military Airlift Command (MAC) suspected MHE requirement calculations to be inaccurate. Currently, MHE is allotted according to a Table of Allowances (TA). If a freight terminal moves X tons of cargo through on a monthly basis, then it gets certain numbers of small forklifts, 10K forklifts, and 40K loaders. But the TA considers neither the cargo flow distribution nor the type of cargo handled. What if most of the cargo comes during the first week, or most of it is rolling stock (trucks, jeeps, etc.) instead of bulk? What about the other physical constraints in the terminal such as dock space, pallet work areas, and cargo holding areas or the ever important constraint of manpower? Also, the TA does not provide war reserve materiel (WRM) equipment requirements. If an aerial port has to support a contingency, that port has to find more forklifts on its own. The port manager either "borrows" them from other areas on base, such as the commissary and the supply warehouses, or rents them from commercial agencies off base.

In a previous project, the AFLMC had developed two simple equations to determine the number of large forklifts and K-loaders needed based on workload.[1] HQ USAF/LET then asked the Center to model the smaller, less expensive forklifts (4K/6K). Unfortunately, solving this problem was not as easy as working with the larger MHE. In an aerial port, K-loaders and 10K forklifts are used in specific areas for specific tasks. The 10K forklifts move finished 463L pallets from pallet build-up pits to holding areas, from holding areas to K-loaders, from K-loaders to holding areas, or back to the pits. K-loaders move pallets between the freight terminal and airplanes. In contrast, small forklifts perform many tasks. A 4K forklift unloading a truck may also be called on to load a pallet. Further, there are more constraints on how a small forklift is used. If a dock is not open, a truck cannot be unloaded. If a holding area is filled, cargo moving into that area is delayed until enough cargo moves out. These kinds of considerations forced a deeper look into the internal workings of an air freight terminal.

The Cargo Flow

After observing how the air freight terminals at two bases operate, we found common elements between the two operations. Although the ports (Dover and McGuire AFBs) varied greatly in size, the flow of cargo and use of small forklifts were generally the same, providing a basis for our simulation.

The cargo flow has two entry points (Figure 1). The first, inbound cargo, arrives on trucks and departs the terminal on

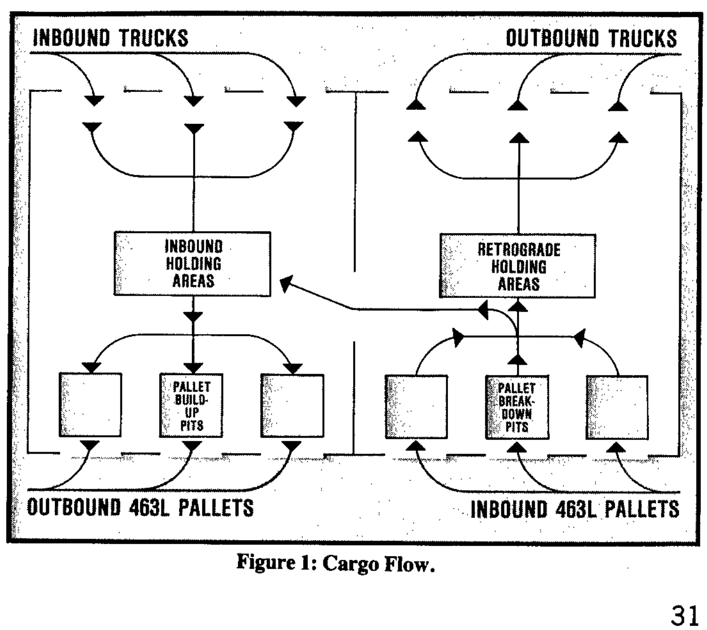


Figure 1: Cargo Flow.

463L pallets. The trucks carrying inbound cargo must first find an open dock and then be unloaded by a forklift. Once the cargo is taken off the truck, it is moved to a holding area according to its final destination. When a holding area has enough cargo to fill a pallet, a forklift and a build-up pit are needed to build the pallet. Once the 463L pallet is built, it leaves the terminal building (via large MHE) and waits for an available aircraft.

The other cargo flow into the terminal is called "retrograde" and consists of 463L pallets arriving by aircraft. These pallets must be broken down into bulk cargo and moved to holding areas to wait for a truck, or moved into the inbound holding areas to go out on another pallet. When a retrograde holding area has enough cargo, it is moved to a truck loading dock and is loaded into a truck with a forklift.

Many constraints complicate the cargo flow. Trucks not needing a small forklift for unloading, such as United Parcel or Federal Express, use the same docks as trucks needing forklifts. If a cargo holding area fills to capacity, the movement of cargo into the holding areas has to stop until the holding area loses some of the excess cargo to pallet building or truck loading. At the truck docks, only one forklift is used per dock, but up to two forklifts may work on a pallet. Some terminals use the same docks for truck loading and unloading and the same pallet pits for building and breaking 463L pallets. Terminals are in constant competition for forklifts, truck docks, pallet pits, and holding area space.

The Simulation

A FORTRAN simulation was used to model the internal workings of an air freight terminal. Designed to be used by the terminal manager on the Air Force standard microcomputer, the Zenith-100, the program is totally menu-driven for ease of use. The manager must make about 30 inputs. First, he describes the workload by entering how many trucks and pallets arrive each day, how much cargo is in each truck and on each pallet, and the arrival window of the trucks and pallets. This sets up the arrival rates of trucks and pallets. Next, he enters resources: the numbers of forklifts, truck docks, pallet pits, and cargo holding areas. Then, he must enter constraints: the time it takes to complete each of the four tasks (truck loading, unloading, pallet build-up, and pallet breakdown), the vehicle in-commission rate of the small forklifts, and the percent of the cargo moving through holding areas, as well as their holding capacities. The manager can save this description for use later in a "what if?" analysis.

The manager can use statistical results of the simulation to find and eliminate bottlenecks. The first statistic is the total time to complete the workload. This is the arrival time period plus any additional time needed to move all the cargo out of the terminal. This tells the manager if he can process one day's cargo flow in 24 hours. The next two results show how forklifts are used in that work time. The first is the average working time per forklift and the second is the average idle time. Forklifts can work for only so many hours a day, especially electric forklifts that must recharge for 8 hours.

The terminal's output is shown in the number of pallets built and the number of trucks loaded. These results help the manager determine if he is meeting the output requirements. He can also use the number of 463L pallets built to determine larger MHE requirements.

Statistics are also provided about the waiting lines into the terminal. For the trucks and pallets entering the terminal, these figures indicate how many must wait—and for how long—for a dock or pit. The next result is the largest number waiting at one time, because this tells the manager if he has trucks backed up to the front gate or aircraft waiting on the ramp to be unloaded. Other queue statistics cover trucks and pallets waiting in the docks and pits awaiting forklifts.

Usage of the forklifts, docks, and pits is shown next. Instead of assigning forklifts to each work area, the model keeps a pool of forklifts and moves individual units when they are needed. It also tracks the average number of forklifts working in an area, a statistic that helps an area manager assign his forklifts and manpower. In addition, the percent of time docks and pits are occupied is calculated, to show whether the docks or pits are the bottleneck.

The last series of statistics show the average amount of cargo in each holding area. These determine if an area is too small for the volume of cargo going through it.

Validation

To prove the model represents a real-world scenario, inputs received from Dover were run for an average day. Terminal managers at Dover verified the simulation adequately described what they actually do on a day-to-day basis. Inputs from Travis AFB, which has a similar set-up to Dover's, were also tested as additional checks. The buildings at the two bases look alike, but internal operations are totally different. Travis receives more cargo over a longer time period each day and takes longer to service it because this base does not have an automated system like Dover's. Despite these differences, the simulation yielded results that accurately mirrored Travis operations. Further, to prove the simulation would work with smaller operations than these two giants, the program was run with inputs from the air freight terminals at Sacramento and Warner-Robins Air Logistics Centers (ALCs). In both cases, our results reflected actual workday statistics.

Implications

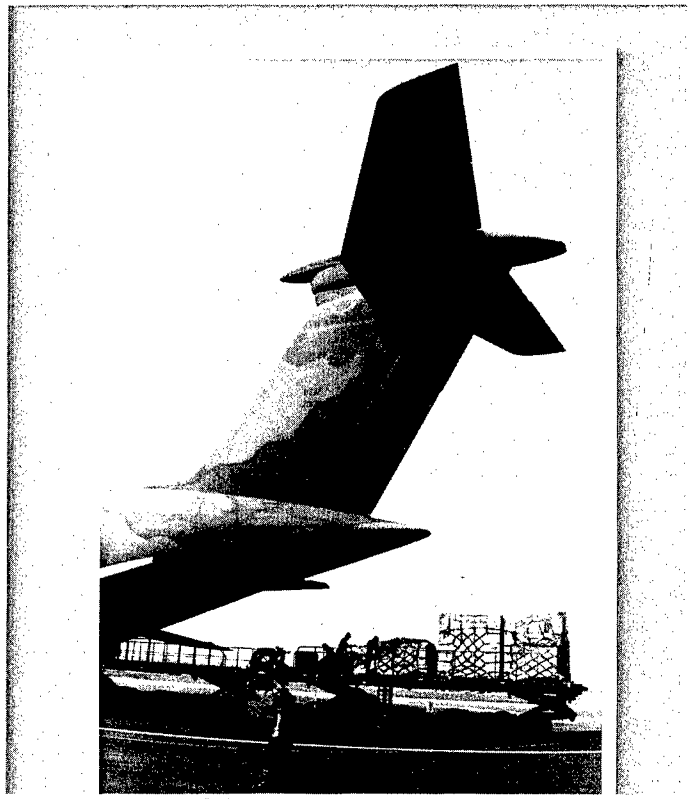
The simulation, of course, can model multiple-day activities. In fact, the terminal manager can use this model to simulate up to 30 days' flow. In all the cases mentioned, the model showed that each terminal had enough forklifts to handle its peacetime workload. After all, the number of forklifts provided to each freight terminal has been decided by trial and error over many years. The resulting TA establishes the greatest number of forklifts ports can have; however, ports usually receive less than the table allows. Unfortunately, a wartime contingency operation does not allow for trial and error to find the number of forklifts needed. Since Operation Plans (OPlans) expect more throughput than the port can provide, most managers do not like to think about what they would do if an OPlan were executed.

The terminal manager can use the model to determine WRM, rather than learn the hard way in a contingency. For each day of an OPlan, he can change inputs to test the ability to support the planned flow. For example, during testing of this model, Dover's aerial port had just received a new OPlan from HQ MAC. Terminal managers suspected they could not support the OPlan, but could not give a definite reason why they felt uncomfortable. Working with experienced personnel at the port, analysts entered only the worst day scenario (more

than four times peacetime cargo flow), gave the port twice its current number of forklifts (plus many other resources the port did not have on hand), and assumed no backlog of work. The results showed one day's projected cargo flow would take a day and a half to clear the port, and more than 15 planeloads of cargo would become backlogged. That was only one day, and the OPlan called for three days of similar flow. It would therefore take the port more than five days (assuming good weather, constant manning, and no equipment breakdowns) to clear the port. By using the model, the port had a much more definite and workable response for MAC.

Even if the port manager is given unrealistic plans or last-minute emergencies, he can use this model to find out what equipment and personnel would be needed to support the flow and "borrow" those resources from somewhere else. The "what-if" capability of the model allows the terminal manager to decide what he needs to meet the workload, using real data rather than MAC planning standards.

Perhaps more important, unsupportable OPlans could be avoided by using this model during plan formulation. HQ MAC might use the simulation to determine how much traffic a port can realistically handle, given its current resources. By consulting with terminal managers, MAC planners can create reasonable war plans so we will not risk losing the resupply battle.



K-loader servicing a C-5 galaxy.

Summary

Although many other areas in the Air Force use forklifts, the aerial ports are one of the most important. In fact, they could be the biggest possible bottleneck in the resupply pipeline. Without a forklift, a pallet cannot be loaded, a plane cannot take off, and a fighter can be grounded for lack of a vital engine part. The aerial port is a weak link if planners assume they can push cargo through without considering real capacity. By using this model, MAC planners and port managers can work to avoid this possible disaster. With sufficient forklifts, docks, pallets, storage space, and a high but realistic workload, supplies will flow through aerial ports and make their final destinations on time.

The model can be obtained by writing or calling AFLMC/LGT (AUTOVON 446-4464; Commercial 279-4464), Gunter AFS, AL 36114-6693.

Note

[1]Sampson, Dale and Ronald W. Hare. *An Evaluation of Material Handling Equipment Requirements*. AFLMC Project #820201, AFLMC, Gunter AFS AL, 5 August 1982.

During deployments, all means of cargo transfer must be put to best use.

ADPA Sponsors Annual Symposium

In conjunction with the Society of Logistics Engineers (SOLE), the American Defense Preparedness Association (ADPA) will sponsor the Fourth Annual Integrated Logistics Support (ILS) Symposium in New Orleans, Louisiana, 3-5 December 1985. The theme will be "Systems Effectiveness Through Logistics." This meeting has become one of the most significant, interactive military-industry occasions. For further information, please contact ADPA, Rosslyn Center, 1700 N. Moore Street, Arlington, Virginia 22209 (703-522-1820).

CURRENT RESEARCH

Air Force Human Resources Laboratory FY85-86 Logistics R&D Program

MAINTENANCE AND LOGISTICS MODELS FOR COMPUTER AIDED DESIGN (MLCAD)
OBJECTIVE: To produce tested analytical models, data bases, and procedures for including maintenance and logistics factors within the computer aided design (CAD) process. A biomechanical model of the maintenance technician will be developed which will enable designers to evaluate maintainability during initial design.
APPROACH: Maintenance and logistics (M&L) factors relevant to CAD will be identified and associated with the various design phases of weapon system acquisition. Several representative factors will be selected for integration with CAD. Computer-based analytical models will be developed and adapted to represent a maintenance technician. Data bases will be developed to support use of the models in a design environment.
(Contact: Alan E. Herner, LRA, AUTOVON 785-3871, (513) 255-3871)

AUTOMATION OF TECHNICAL INFORMATION (ATI)
OBJECTIVE: Investigate, develop, and prototype a broad range of specifications, standards, and architectures to support efforts to automate technical information such as the Automated Technical Order System (ATOS); an Engineering Data Computer Assisted Retrieval System (EDCARS); the Integrated Maintenance Information System (IMIS); and the Integrated Design Support (IDS) System.
APPROACH: Participation in and integration of joint efforts to develop a system architecture for the distribution of ATI and coordination with other technologically related Air Force programs.
(Capt Paul Condit, LRA, AUTOVON 785-3871, (513) 255-3871)

MAINTENANCE PERSONNEL REQUIREMENTS FOR DISPERSED OPERATIONS
OBJECTIVE: To develop analytic techniques capable of evaluating the impacts of broadened job/task responsibilities for aircraft maintainers on combat performance in dispersed, small unit operations and on manpower, personnel classification, and training policies.
APPROACH: Alternative assignments of identified combat maintenance tasks will be evaluated through simulation. Criteria for reassigning tasks to overcome manpower shortages or to create resiliency in deployed units will be tested through innovative extensions of occupational/task analyses applied to existing maintenance specialties. The feasibility of specialty consolidation will be evaluated through a model that can balance costs of changes to job structures aimed at creating skilled generalists against risks of sortie loss in dispersed operations under the current specialist system.
(Edward Boyle, LRC, AUTOVON 785-2606, (513) 255-2606)

MAINTENANCE LIMITATIONS IN A CHEMICAL ENVIRONMENT
OBJECTIVE: To develop and validate methodology to determine how the performance of critical combat maintenance tasks is impacted by a chemical warfare environment. The methodology will be developed and then tested and applied in a simulated field, chemical environment. The data collected shall also be used to input combat models being developed by the Air Force's Harry G. Armstrong Aerospace Medical Research Laboratory (AAMRL). All performance limitations observed will be isolated, identified, and re-examined. Suggested workarounds, policy and procedure changes, and equipment/clothing redesigns are expected to result from this work.
APPROACH: Initial research design and data collection methodology is being developed in-house. During Phase I, final methodology will be tested with data collection results sent to AAMRL for modeling inputs. Phase II will concentrate on and isolate specific preperformance limitations discovered during Phase I. These limitations will be further tested for a more exact isolation of the causes to determine the effects on combat sortie generation. Phase III will bring together the data collected in Phases I and II for an extensive analysis. Limiting factors, workarounds, and recommendations for present and future concern will be submitted through this Phase.
(Capt John Duhamel, LRC, AUTOVON 785-2606, (513) 255-2606)

AUTOMATED MAINTENANCE PERFORMANCE AIDS
OBJECTIVE: To develop and evaluate prototype automated aids for presentation of technical information for use by maintenance technicians through automation to allow selective data display tailored to individual skill and experience as well as to provide rapid and reliable update.
APPROACH: Research to develop a specification that will describe the capabilities needed in an automated technical order system to ensure the ultimate user of the system—the maintenance technician—can and will effectively use the system. A prototype system has been developed and tested for an intermediate level maintenance shop. A refinement of this system was field tested at Grissom AFB, Indiana, in August 1985. Design studies will focus on hardware and software capabilities and the issues of system utilization, and user acceptance of the system.
(Lt Jeff Clay, LRC, AUTOVON 785-2606, (513) 255-2606)

INTEGRATED MAINTENANCE INFORMATION SYSTEM (IMIS)
OBJECTIVE: To develop an integrated information system for the flight-line maintenance technician which will provide all the diagnostic, technical order, training, and work management data needed for job performance.
APPROACH: A series of design studies and prototype field tests will be conducted to establish the display formats, man-computer interface, and information requirements for IMIS. A portable maintenance computer will be developed in conjunction with the development of interfaces for airborne and ground-based computer systems. The prototype will be field tested to evaluate the design requirements for integrating and displaying maintenance information.
(Capt Joseph Von Holle, LRC, AUTOVON 785-2606, (513) 255-2606)

AUTOMATED FLIGHT-LINE MAINTENANCE AID
OBJECTIVE: To develop a prototype computer-based graphics and information system for use by maintenance technicians for on-aircraft maintenance—both routine tasks and battle damage assessment.
APPROACH: Hardware and software capable of storing, rapidly retrieving, and presenting both routine maintenance and automated battle damage repair data will be developed. The system will be a small, portable, rugged device capable of handling a variety of procedural, structural, and systems information.
(Capt Stanley Collins, LRC, AUTOVON 785-2606, (513) 255-2606)

COMBAT MAINTENANCE CAPABILITY
OBJECTIVE: To develop and test methods by which the Air Force can measure, quantify, and improve its combat maintenance capability. Such methods can be used by Air Force decision makers in determining policies, planning resources for combat, preparing units for combat, conducting operational exercises, enhancing combat logistics and maintenance effectiveness, and influencing the design of more supportable future weapon systems.
APPROACH: The initial work has been accomplished and technical reports detailing the methodology are available. The methodology is now being validated using F-111F data. The expected product is a validated methodology to determine the capability of the maintenance organization to perform as required in a combat environment.
(Richard E. Weimer, LRC, AUTOVON 785-2606, (513) 255-2606)

LOGISTICS EXPERT SYSTEM
OBJECTIVE: To develop a system that will model depot system program manager (SM) and item manager (IM) decision-making requirements at air logistics centers (ALCs) and to provide a prototype, automated logistics decision support system using artificial intelligence hardware and software.
APPROACH: IM and SM decision and information flow processes will be modeled prior to defining the hardware and software requirements. This modeling will provide the initial knowledge base and decision rule structure for developing the expert system software. Future efforts will develop and demonstrate the Logistics Expert System prototype.
(Capt Dennis Spray, LRS, AUTOVON 785-3611, (513) 255-3611)

LOGISTICS EXERCISE (LOGEX) PROGRAM
OBJECTIVE: To improve the wartime operational readiness of HQ USAFE logistics command and control personnel by providing them combat focused training materials.
APPROACH: Through use of USAFE subject matter experts, both contractor and in-house personnel will develop the first product on NATO wartime logistics reports. This training program will be evaluated during an upcoming NATO exercise. Follow-on training modules are being defined in coordination with USAFE personnel.
(Capt Kathleen Sexton, LRG, AUTOVON 785-5910, (513) 255-5910)

WARTIME LOGISTICS DEMAND RATE FORECASTING
OBJECTIVE: The objective of this research is to provide a means for predicting, measuring, and testing wartime demands on logistics resources worldwide. Combat data will be collected and used to describe the difference between peacetime and wartime demand rates. This data will be placed in a computerized data base and analyzed in order to develop the necessary tools to perform the forecasting of wartime demand rates.
APPROACH: This effort will apply the same tasks to similar parallel efforts. The

study has been divided into five tasks: (1) collect combat data, (2) normalize the combat data, (3) insert data in a retrieval system, (4) develop automated anlaysis packages, and (5) document results. The end products of this study are software, user's guide, programmer's guide, and applicable combat data bases.
(James C. McManus, LRC, AUTOVON 785-8418, (513) 255-5910)

ADVANCED ON-THE-JOB TRAINING SYSTEM
OBJECTIVE: To develop, demonstrate, test, and evaluate an Advanced On-the-Job Training System (AOTS) for USAF job site training. AOTS is a large-scale research and development effort to systematically apply state-of-the-art technology to on-the-job training (OJT).
APPROACH: AOTS will effect the design and demonstration of four major subsystems addressing the management, evaluation, computer support, and personnel/logistics support. The program evaluates state-of-the-art technology innovations to be introduced incrementally into the OJT program and also plans for the transition of the prototype Air Force wide. The payoff is enhanced relevance of job site training to mission readiness. The AOTS project will be developed, demonstrated, tested, and evaluated at Bergstrom AFB by a joint blue-suit contractor effort. The host weapon system is the RF-4C assigned to the 67th Tactical Reconnaissance Wing at Bergstrom. The effort will include four test Air Force specialties (AFSs): 431X2C, Tactical Aircraft Maintenance; 426X2, Jet Engine Maintenance; 732X0, Personnel; and 811XX, Security Police. The four-year prototype development effort was initiated 1 Aug 85 with the design phase. Phase II is development of the computer software for operational OJT, and Phase III is the operational test and evaluation (OT&E) effort at Bergstrom AFB.
(Major Martin J. Costellic, AFHRL/OL-AK, Bergstrom AFB TX, AUTOVON 685-2667, (512) 479-2667)

AFIT School of Systems and Logistics
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(Continued from Summer issue)

Captain John J. Fraser — ADA147666
Captain Donald G. Davidson — LD60908A
Adapting Logistics Models to a Microcomputer for Interface With Computer-Aided Design Systems

Captain Gary Davis — ADA147016
Captain Roger Edwards — LD60622A
Determination of Training Requirements for New Logistics Support Analysis Managers Using Instructional Systems Development

Major Henry B. Williams — ADA147296
Captain Philip C. De Bruin — LD60596A
A Comparison of Retirement Intent Between Prior and Non-Prior Enlisted Officers

Mr. Thomas E. Disz — ADA147121, LD60621A
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READER EXCHANGE

Dear Editor

Somewhere, sometime, someone had better start listening. In the first 13 pages of the Summer 1985 issue of Air Force Journal of Logistics which are devoted to Reliability and Maintainability, the word "survivability" is not mentioned once. The first time it appears is in the glossary on page 15. What a waste to put all that effort and money into reliability and maintainability only to have it lost because what we paid for wasn't survivable in a contingency or war. Are we buying improved aircraft that won't fit into hardened aircraft shelters or replacement test equipment that can't be dispersed, won't support a dispersed aircraft operation nor fit into a hardened avionics building? We better check and we'd better amend our program so it's RMS: Reliability, Maintainability, Survivability.

Major General Lewis G. Curtis, USAF
DCS/Logistics
HQ USAFE
APO New York 09012-5001

Dear Editor

It's very regretful to hear that the Air Force Journal of Logistics will not be distributed as it is now. It's probably one of the most informative publications in the Air Force library. I've taken steps to have PDO include our office on the mailing list.

In the past, after I've read the publication, I've shared it with my next level supervision and so on down the line until it has reached the working level.

I've used various articles as points of discussion in my staff meetings and references for related subjects in transportation classes.

Thank you for the excellent quality of this publication. Thanks also for including us in the distribution as long as you have been able to do so.

George E. Froerer
Chief, Shipment Planning Section
Directorate of Distribution
Ogden Air Logistics Center
Hill AFB UT 84056

Editor's Note

Because the Journal had to limit the number of copies per issue, we eliminated the complimentary distribution to Logistics Civilian Career Enhancement Program (LCCEP) members. Journal readers are encouraged to make sure they receive continuous distribution by contacting their local publishing distribution office (PDO).

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"Victory smiles upon those who anticipate the changes in the character of war, not upon those who wait to adapt themselves after the changes occur."

Air Marshal Guilo Douhet

"During my 21 years as an Air Force officer and pilot, I've known some people whose accomplishments in combat earned distinguished awards for bravery and whose uniforms are decorated with rows of ribbons attesting to their courage.

Some of them qualify as genuine heroes who took enormous personal risks to accomplish their assigned missions.

Yet somehow, I'm more impressed with another kind of heroism that rarely receives due recognition. I'm referring to the kind of courage required to work 12 or more hours every day in all kinds of weather, for little pay, even less recognition and precious few thanks.

I'm referring to those who maintain airplanes and provide the fuel, ordnance and all the other support needed to keep the planes ready for combat.

Yours is not an emotional, spur-of-the moment courage, but a quiet, steady courage. You can expect neither the thrill of flying nor the chance for glory in aerial combat, yet you work longer, under worse circumstances and for less pay than I do, and with more dedication.

I didn't always understand. When I was a new pilot I expected a perfect jet—on time, every time. Later, as I matured, I began to understand that which I had enjoyed for so many years.

Now I know beyond a shadow of doubt where the heart and soul of the Air Force lies—in its enlisted force. You make the Air Force work; your dedication and loyalty are the most precious gifts a commander can have.

I salute the real heroes with great pride."

Colonel Kerry G. Herron
Deputy Commander for
Adversary Tactics
57th Fighter Weapons Wing
Nellis AFB, Nevada

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